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The Bill as Amended.

THE arduous labours of Standing Committee C having been completed, the Electricity (Supply) Bill in its amended form has been returned to the House of Commons, and last week the Stationery Office placed copies of it on sale. They will no doubt be studied with keen interest, for the Bill has been materially changed since it was sent to the Committee; it now occupies 33 pages without the schedules, as compared with 24½ in its original form, and comprises 45 clauses, as compared with 40. Nevertheless, it still lacks features which we should like it to include, and contains a great deal that we would rather were absent from its contents.

The most fundamental alteration that has been made is certainly that which constitutes the Electricity Commissioners advisers to the Central Electricity Board, and charges them with the duty of preparing schemes and "transmitting" them to the Board, which may modify the schemes as it thinks fit, and, if it adopts them, must carry them out. In the first instance the Board was subordinated to the Electricity Commission, a plan which, as we then pointed out, would have been fatal to its efficiency. Not only does the new system conform to recognised business principles—it is also in accordance with the spirit of the Act of 1919, under which the Commissioners were called upon to prepare schemes in default of the submission to them of suitable proposals. It has been urged that in the seven years of its existence the Commission has not evolved a single scheme; under the new *régime*, however, there will be no alternative source of proposals, and presumably the staff of the Commission will have to be expanded to cope with the additional burden—at the expense of the Board.

The Board, then, will be in the position of a board of directors, controlling the operations of a gigantic concern whose business it will be to buy and sell electricity, and, incidentally, to make sufficient profit to cover all its expenses, which will include not only the cost of administration, but also the capital charges on its main transmission lines and such standardisation of frequency as it may carry out—at the same time reducing the cost to the consumer. To conduct such a vast undertaking with success will tax the best brains of the country, and we are glad that a position of dignity and responsibility has been conferred upon it which may attract men of the right calibre. Such men are scarce, and they already have important interests committed to their charge; such salaries as can be offered by a

Government department can carry little weight with them—we must look to their patriotism and public spirit to induce them to shoulder the burden. Apparently, once appointed, they cannot lay it down before the expiration of at least five years.

Incidentally, the Bill provides that to the servants of the Board shall be paid, "on retirement or death, such pensions and gratuities as the Board may determine"; this, we should think, is an unprecedented extension of welfare work.

The next amendment of fundamental importance is the provision of an independent tribunal for the hearing of appeals against requirements of the Board which are alleged to be "prejudicial" to the authorised undertakers who lodge the complaints. There is a strong tendency in these bureaucratic days for Government departments to seek to place themselves or their officers above the law, and to remove the settlement of disputes from the jurisdiction of the Courts. This tendency was manifest in the Bill as originally drawn, the only appeal foreshadowed under Clause 4 being to the Electricity Commissioners, who would themselves have been the authority that sanctioned the scheme complained against; under Clause 5 a further appeal was allowed to owners of selected stations who considered the Board's directions unreasonable—they could lay their complaints before the Railway and Canal Commissioners. The Bill as amended provides for the arbitration of a barrister or advocate in both cases, and further requires that an order which authorises the compulsory purchase of a generating station shall come before both Houses of Parliament before it can be carried into effect. These provisions, we hope, will serve to protect the rights of authorised undertakers against oppression, the fear of which, though possibly groundless at the moment, cannot be regarded as illusory in view of what the future may bring forth.

With regard to the acquisition by the Board of main transmission lines, it is satisfactory to note that the Board is now required to bear the cost of any consequential alterations of switchgear, &c., that may be necessary; disputes on this score, as well as the determination of the cost of standardisation of frequency (which the Board must bear) are now subject to the final decision of an independent arbitrator. Similarly the provision enabling the Board, on giving a bulk supply to an authorised undertaker, to require the latter to take the whole of the electricity for its needs from the Board, is made subject to arbitration.

An important alteration consists in the removal of the specified term of seven years from the date of commencing to take a supply from the Board, during which the Board must not charge more for a bulk supply than the owners of a selected station could themselves have generated at; as the clause now stands, there is no time limit. This constitutes a powerful safeguard against the risk of rising prices as the Board's expenses grow. No less important is the power given to the Electricity Commissioners, in the case of a station (not a selected station) which in their opinion cannot generate more cheaply than the Board can supply in bulk, not merely to require the undertaker concerned to lower his prices, as in the original Bill, but actually to order him to take a supply in bulk and shut down his plant. This "big stick," however, is also made subject to arbitration in case of dispute.

An amendment at which no one will cavil is the extension of the compensation clause to cover the interests of employés who are affected by changes in the operation or ownership of a generating station, or of a main transmission line, due to the working of the Act.

Many other alterations have been made, which need not be detailed at the moment. In spite of the radical changes above-mentioned, the principle on which the Bill is based remains untouched: it establishes a "middle-man" in the electricity supply industry, with unprecedented powers, and with authority to spend borrowed capital up to a limit of 33½ millions sterling, on which the industry, with the help of the consumer, will have to pay interest and sinking-fund charges.

Will this give us all cheap electricity?

Academic Changes.

Last week two noteworthy events took place in the academic history of London, neither of which affords material for congratulation, for they mark the passing of an era during which electrical engineering has grown from infancy to maturity—a period crowded with discoveries and inventions, with which no previous half-century in the world's history can bear comparison. One is the closing of Finsbury Technical College on July 26th; the other is the retirement of Prof. J. A. Fleming, D.Sc., F.R.S., from the chair of electrical engineering at University College, London.

The Finsbury College was the first of its kind, the forerunner of the numerous excellent technical colleges which have since sprung up all over the world; it was there that Ayrton, Perry and Armstrong introduced new methods and taught new ideas which have inspired countless students and helped to keep this country in the very forefront of scientific and technical progress, in spite of the many difficulties which beset the path, not least of which was the perennial lack of funds (the determining factor, indeed, in the closing of the College). Meldola, too, must be mentioned, who, with the beloved Silvanus P. Thompson, taught at the College for over 30 years; these two great workers endowed the College with a world-wide reputation, which suffered no loss of lustre in the hands of their successors—Professors Dalby, Coker, Morgan, and Eccles, of whom the last-named is now the president-elect of the Institution of Electrical Engineers.

Finsbury is closed—but its renown will endure whilst English is spoken.

Dr. Fleming is in his 77th year, but whenever he appears in public the vigour and fluency and the wealth of knowledge with which he lectures astonish those who know his age, and suggest that he possesses the secret of perpetual youth. He was a student at University College and the first professor of electrical engineering at the same College—a position which he has occupied with distinguished ability for over 40 years. We gave an account of his career when he delivered the first Faraday lecture during the Jubilee commemoration of the Institution of Electrical Engineers (Elec. Rev., February 24th, 1922, p. 257). Whilst we regret to record his retirement from the professorial chair, we cannot doubt that his abounding energy will compel him to retain a lively interest in the progress of electrical science, and that he will continue his work with unabated enthusiasm.

The Spanish Market.

Although the recent report on Spain by our Commercial Secretary at Madrid (Capt. U. de B. Charles) is disappointing in many respects, the position of British trade in this difficult market is not without its brighter aspects. Last year the United Kingdom surrendered its position as the leading supplier of goods to Spain to the United States, although we were still Spain's best customer, and the result was an improvement in the favourable Spanish trade balance. We secured a fair share of the electrical business, but the competition of the United States and Germany was greatly in evidence; in only one class—electric cables—did Great Britain hold the lead.

While general trade is handicapped by high protective tariffs, there does not appear to be much electrical manufacturing activity in Spain, and therefore it is not certain that this particular handicap is so pronounced in the case of electrical goods. It is evident that Germany has in all departments a firm footing in the country, while the United States is also building up a good connection. It is to this aspect of the market that British manufacturers must direct their attention.

Capt. Charles reiterates the necessity for very careful study of the customs, prejudices, and habits of the Spanish. This is necessary in every market, but in Spain it assumes additional importance. The Germans appear to have adapted themselves to the conditions to a remarkable degree, and it is essential that British traders should not be behind in this respect.

Wireless Transmission.—II.

The Daylight Effect and Atmospheric Phenomena.

By CHARLES E. SNELL.

In a previous article* the subject of wireless transmission has been discussed with particular reference to the theoretical aspect, and the means by which theory and practice can be brought into agreement has been suggested.

Associated with wireless transmission there are phenomena of considerable practical importance, and they may be grouped broadly into two principal divisions, *viz.*: the daylight effect and atmospherics, the former being the one which has a known definite influence on the received energy, and in consequence it requires to be especially considered in conjunction with any suggestion made with regard to the theoretical basis of transmission. This article will deal, therefore, with these phenomena, and the object in view will be to demonstrate that the views put forward in the previous article lend themselves to the elucidation of the daylight effect and atmospherics, together with the problems which arise in this connection.

It was observed at a very early stage in the development of wireless transmission that the range at night is greater than that attained by day, and the suggestion put forward in explanation of this effect was that the ultra-violet rays emanating from the sun cause ionisation of the gaseous molecules of the air, and hence an absorption of the wireless "waves" during daylight. Ionisation of the air is still the factor which is considered as being responsible for the variations in received energy, but the original form in which this idea was expressed has been modified by the inclusion of a further suggestion, *i.e.*, that refraction and reflection of the wireless "waves" arise from this same cause during the hours of darkness. The conductivity of the earth's surface receives, in this method of dealing with the case, no consideration, and the implied assumption is, therefore, that the whole of the received energy is derived from the air dielectric; notwithstanding the fact that it is inconceivable that daylight transmission could show—as it does show—such complete immunity from the several possible sources of interference if such were the case.

It is necessary, in these circumstances, to reconsider the matter, and if, as a first step in this direction, the data pertaining to this phenomenon are closely examined, the following outstanding facts will be discerned:—

(*a*) The efficiency of daylight transmission is remarkably consistent, and the daylight value of received energy can, therefore, be taken as a standard of comparison in the consideration of variations.

(*b*) Night transmission never shows a value of received energy less than the daylight value; in most instances a considerable increase is shown.

(*c*) Night transmission received energy values are subject to wide fluctuations, yet there exists, nevertheless, one regular feature, *viz.*, a particular fluctuation which is associated with the months of the year.

The constancy of the daylight range, coupled with the fact that night transmission furnishes a variable addition to that range, suggests that there is a medium of transmission which is unaffected in its efficiency either by day or by night; and that another (supplementary) medium, the efficiency of which is variable, enters into night transmission. The two media involved in wireless transmission are the earth's surface and atmosphere, and that which can possess the required constant electrical efficiency is the earth's surface. This must mean that the conductivity of the earth's surface is the principal factor in daylight transmission and that this conductivity is supplemented at night by a variable increase in the transmission efficiency of the air dielectric.

In the general meteorological and electrical conditions pertaining to the earth's atmosphere there is no feature which can be considered as being especially applicable to the period of darkness, and it is impossible, therefore, to ascribe to these conditions the improved transmission efficiency of the air dielectric at night. Observation data, whilst fully supporting this expectation, furnish, however, two important facts from which a conclusion can be drawn. The two facts are:—

(i) The sun's mean altitude is definitely connected with the improved efficiency of night transmission, and (ii) the variations in received energy at night are more prevalent over land and in the vicinity of land masses.

It is evident from (ii) that the variations in efficiency are influenced by the nature of the earth's surface, *i.e.*, broadly stated, whether that surface is the surface of the ocean, or a land surface, which suggests that regard should be had to the earth's surface rather than to the upper atmosphere in seeking the reason for the variations in the electrical efficiency of the air dielectric. That there is, in general, radiation from the earth's surface at night is an accepted fact, and there are a number of reasons favourable to the idea that such radiation has distinct and characteristic features not applicable to daylight conditions; so that night radiation from the earth's surface becomes a conceivable cause to which may be attributed the improvement shown in night transmission. Furthermore, it is understandable that the sun's mean altitude should be related to the night radiation, and hence there is an agreement with the observed factor stated above in (i). The conclusion then, for the reasons adduced, is that it would appear to be more in accord with the known facts if this phenomenon were designated as the "night radiation effect" in preference to applying to it the term "daylight effect."

At this stage it will be useful to recapitulate the several conclusions derived from this examination of wireless transmission, which are as follows:—

1. Wireless transmission is dependent partly on the electrical conductivity of the earth's surface and partly on the dielectric properties of the earth's atmosphere.

2. The electrical conductivity of the earth's surface is invariable and is the contributory cause of the constancy of efficiency shown in daylight transmission.

3. The variations in transmission efficiency at night are occasioned by variations in the air dielectric brought about by night radiation from the earth's surface.

4. The night radiation from the earth's surface is a function of the sun's mean altitude so far as this radiation influences the electrical efficiency of the air dielectric; other causes, however, occasion transient variations in the night radiation sufficient to obscure this relationship in isolated observations.

5. The transient variations in the earth's night radiation are present to a greater degree in cases of overland transmission and in the vicinity of land masses.

* See ELEC. REV., July 23rd, 1926.

In fig. 1 the broad distinction between day and night transmission, and between the latter and the sun's mean altitude, is depicted in graphic form; and as regards the day transmission the constancy of this is such that it can readily be checked in practice. The night curve is, however, affected by subsidiary causes and, as a consequence, its more practical form is similar to that shown in fig. 2. If observations are made on only a few nights and at irregular intervals, it is possible, of course, for the relationship with the sun's mean altitude

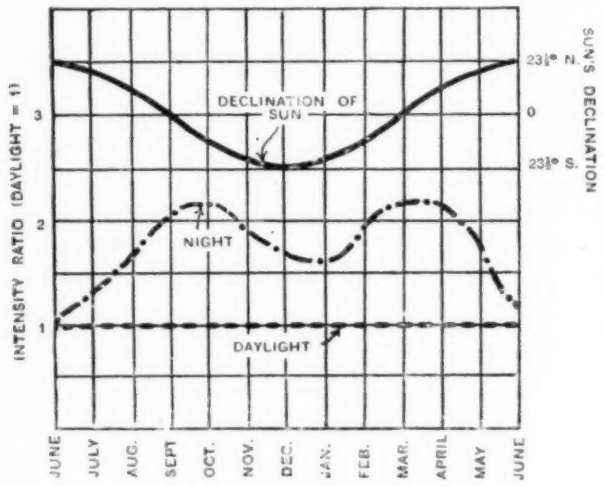

Fig. 1.

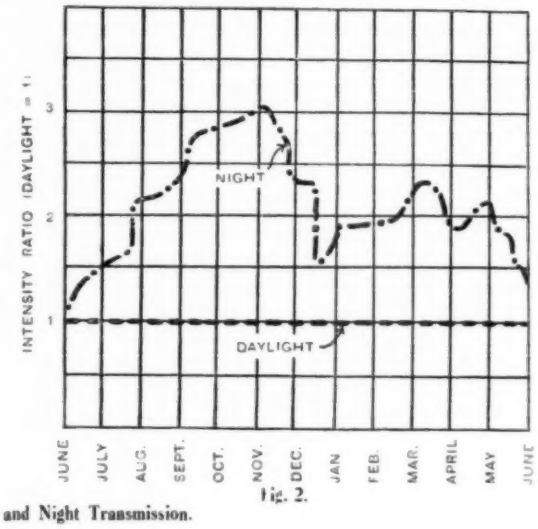

Fig. 2.

Broad Distinction between Day and Night Transmission.

to escape notice, but regular observations demonstrate it in no uncertain manner.

A consideration of the physical characteristics of the earth's surface and its associated atmosphere is obviously a very essential adjunct to the study of wireless transmission, and in this respect the relative dimensions of things, even when comparatively small areas are under review, is a factor which it is important to keep prominently in mind. For instance, fig. 3 is a cross section, to scale, of a portion of the earth's surface one thousand miles in extent, and when it is considered that the mere thickness of the line representing the surface boundary is sufficient in this case to embrace a height equivalent to the highest land elevation, it cannot fail to be appreciated why it is that wireless transmission is so essentially a matter of the electrical conductivity of the earth's surface.

It remains now to discuss the second of the phenomena associated with wireless transmission, *viz.*, "atmospherics"—the plague-spot of wireless. The impression that atmospherics are "natural electric waves," and the possibility of their having an extra-terrestrial origin in certain cases, appears to have been formed partly by reason of the fact that the receiving aerial is specifically designed for the reception of high-frequency oscillations, and that it is in consequence selective (by means of tuning) for a given frequency. It is particularly important to bear in mind in connection with the study of atmospherics that, although a receiving aerial is selective as regards high-frequency oscillations, yet it is at the same time equally sensitive to, and quite non-selective in respect of, electrical impulses which do not possess the specific characteristics of high-frequency oscillations. What really happens is that any form of electrical impulse acting on the receiving aerial system causes it to oscillate *momentarily* at the frequency to which the system is for the time being tuned, and the following experiments are of interest in this connection:—

1. A charged ebonite rod permitted to discharge to the earth wire of a receiving installation gives rise to the characteristic "atmospheric" click in the telephone; and this occurs quite irrespective of the frequency to which the aerial system is tuned.
2. A voltaic battery of from 3 to 4 volts connected across a length of from 3 to 4 feet of the earth wire gives rise to similar clicks if one connection of the battery is made and broken at intervals; and again this occurs irrespective of the aerial tuning.

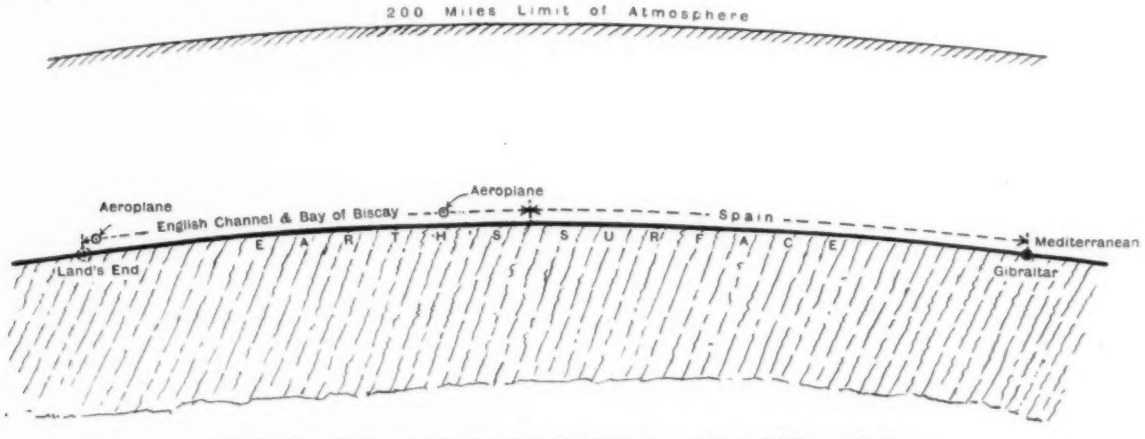

Fig. 3.—Cross Section of a Portion of the Earth's Surface, to Scale, 1,000 miles in Extent.

These experiments, which illustrate both the purely electrostatic and electrodynamic impulsing of the aerial system, can be carried out with similar results on the aerial side; and although experiments of this type do not appear to have been used hitherto, yet there is nothing mysterious in the fact that they succeed, for, after all, the aerial system is, as has been shown, essentially a form of condenser, and the extreme sensitivity of the telephone receiver is, of course, well known. Nevertheless, these experiments serve to demonstrate very clearly that the collection and analysis of records relating to atmospherics is unlikely to furnish any assist-

ance so far as the solution of the problem of eliminating this source of interference is concerned; furthermore, they make clear the reason, *viz.*, that a receiving aerial is not exclusively responsive to high-frequency oscillations; it is equally responsive to electrostatic and electrodynamic impulses. Hence it is easy to realise the difficulty surrounding proposals to eliminate the interference by any modification of the design of the receiving *apparatus*. The Dieckmann cage method of shielding the aerial side attacks the problem in the right direction, *viz.*, a modification of the aerial system, and it is unquestionably very efficient in the reduction of interference, but, besides being somewhat expensive, it does not and cannot, unfortunately, eliminate that part of the interference which emanates from the earth-wire side of the system.

Considered apart from the question of the elimination of the interference caused, this phenomenon of atmospherics possesses features of interest in relation to transmission; for it is the fact that characteristics similar to those applicable to the transmission of high-frequency oscillations are identifiable, and this is to be expected if the views with regard to wireless transmission are a reasonable approximation to the truth.

Atmospheric electrification gives rise to two principal types of discharge, *viz.*, from cloud to cloud, and from cloud to the earth's surface. In the former case it is the air dielectric which is exclusively concerned, whilst in the latter case both the air dielectric and the earth's surface are involved. These discharges produce characteristic clicks in the telephones, but the click is more emphatic when the discharge is to the earth's surface; thus verifying the view that wireless transmission is partly electrostatic induction and partly conductivity of the earth's surface. Further, the electrical energy released by a flash of lightning can be described without exaggeration as prodigious, yet during daylight 200 miles is the limit at which the discharge affects receiving apparatus of non-amplifying design, and this demonstrates the view that neither the potential of the earth's surface, nor the potential of the air dielectric, is appreciably raised outside the immediate zone of discharge. Finally, these discharges affect wireless receivers over greater distances at night; which means, in practice, that whereas during daylight the interference is confined to discharges taking place within, say, a radius of 200 miles, at night the radius is increased at times probably to as much as 2,000 miles. As the only reasonable explanation is that the night radiation from the earth's surface improves the electrical efficiency of the air dielectric, there is agreement in all respects between the transmission of the discharges arising from atmospheric electrification and the transmission of high-frequency oscillations, thus showing, as would be expected, that the media involved in this transmission do not possess selective characteristics.

Although it is generally assumed that most of the interference of the nature under review arises from causes associated with atmospheric electrification, this is not the case, as there exists another source, *viz.*, earth currents. Earth currents are a factor in land-line and submarine cable telegraphy, and, by causing slight potential variations in the vicinity of the ground connection of the receiving aerial system, they are equally a source of interference in wireless reception. The fact that, in the case of wireless reception, the presence of earth currents is seldom observable during the day, and almost always at night, suggests that their origin is in the equalisation of potential differences between the materials of the earth's surface.

The essential features with regard to the phenomenon of atmospherics can be summarised as follows:—

(*a*) Atmospherics show transmission characteristics similar to those applicable in the case of high-frequency oscillations.

(*b*) Atmospherics affect a receiving aerial system by impulsing it, thus causing a momentary oscillation at the frequency to which it is, for the time being, tuned; they are in themselves non-oscillatory.

(*c*) In addition to atmospherics, earth currents circulating in the vicinity of the receiving aerial system are a source of interference.

It will be realised that, commencing with an examination of the theory and practice of wireless transmission as represented by daylight conditions, it has been possible to derive conclusions which can be satisfactorily extended, not only to explain the special effects during the hours of darkness, but also to show the mode of transmission of the discharges arising from atmospheric electrification. Wireless transmission thus apparently reduces to the simple electrical case illustrated diagrammatically in fig. 1 of the previous article; and although the use of high-frequency oscillations is the best method, both with regard to efficiency and selectivity, actually the aerial system employed is equally operative untuned and by means of any form of electrical impulse. Hence, no special electrical theory is involved, but merely a particular physical interpretation of well-known principles.

Nevertheless, as the history of the subject shows, it required true genius to foresee and develop this physical interpretation, whilst it is also correct to say that it is the initiative of the wireless engineer that has been largely responsible for the subsequent progress. If wireless transmission by being reduced to its simplest theoretical aspect loses in the process much of the mysticism and romanticism which has enveloped the subject, electricians in general and wireless engineers in particular will surely not regret the loss, provided only that in exchange they find an easier method for dealing with the practical problems they are called upon constantly to solve.

A Water Turbine Governor.

New and Simplified Apparatus of Gilbert Gilkes & Co., Ltd.

For years the speed regulation of water turbines has exercised the ingenuity of hydraulic engineers, and though the many problems involved have now been solved, the cost of the governing apparatus still forms a large proportion of the total cost of hydro-electric plant.

With a view to reducing this cost and simplifying the governing mechanism, Messrs. Gilbert Gilkes & Co., Ltd., of Kendal, have recently introduced an ingenious regulator. It is designed to control the speed and voltage of a plant by supplying supplementary artificial load, so as to maintain a constant load on the turbine under all conditions.

The governor consists of a magnet frame suitably wound with series and shunt windings, and a brake drum rotating in the magnetic field produced by this frame. The drum can be made of cast iron, or steel, and is mounted upon a shaft which is driven directly by the turbine. The rotation of the drum sets up eddy currents in it, which tend to check its rotation and so put a load on the turbine. Naturally, if any considerable power is being absorbed the drum gets hot, and to prevent an excessive rise of temperature it is arranged to be water cooled. The design of the brake is protected by British patent No. 254,383.

In order to secure satisfactory regulation it is neces-

sary to vary the excitation of the brake field. This is done very neatly by connecting the shunt and series windings so as to oppose one another. When no useful external load is being carried by the plant no current will flow through the series winding, the shunt winding of the brake field will exert its full effect, and powerful eddy currents will be set up in the rotating drum. The number of ampere-turns is so designed as to cause the brake to put full load on the turbine, less the power required to excite the dynamo. When the full useful output is required, full-load current flows in the series windings and the ampere-turns are so arranged that the series and shunt windings are completely balanced. No eddy current is generated in the brake drum, and it revolves freely without putting any load on the turbine.

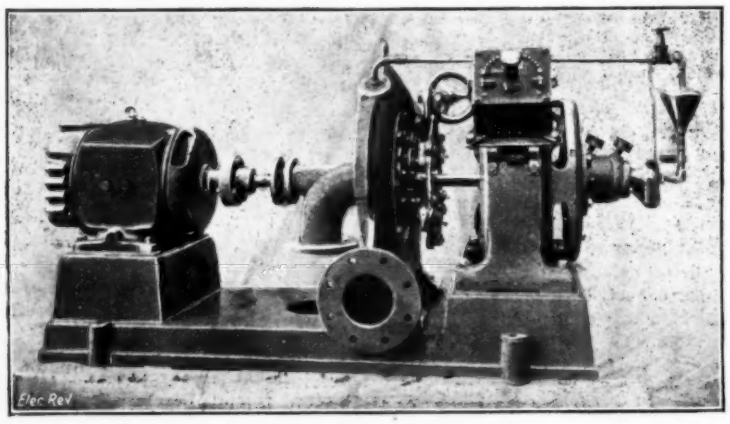

Fig. 1.—Hydraulic Turbo-Dynamo Controlled by New Governor.

Shunt regulators are provided for the dynamo and brake-magnet fields, and a diverter resistance is used to vary the compounding effect of the series turns of the brake field. Simple manipulation of these regulators enables the speed and voltage characteristics of the set to be varied as desired.

If at any time the water supply to the plant should fall below that required to carry full load, the turbine guide vanes will be closed to correspond with the water supply and the resistance of the brake shunt regulator will be increased to reduce the power absorbed by the brake, but the governor will continue to work perfectly, as the neutralisation of the brake field occurs at a correspondingly smaller value of the output of the plant in amperes.

A photograph of a small plant controlled by the new type of governor described is reproduced in fig. 1; the dynamo is shown on the left, with the turbine in the centre and the brake governor with diverter regulator on the right.

The cooling of the brake drum is effected by introducing water from the turbine casing to the hollow shaft that carries the turbine rotor and brake drum. The water is caused to circulate through the drum and exhaust into the suction pipe of the turbine, about 1/10th of a gallon per minute of cooling water being required per kW output of plant. In the illustration the inlet branch of the turbine is shown facing the reader, whilst the discharge bend is to be seen on the left of the turbine. No inlet or suction piping is shown. The handwheel for operating the turbine guide vanes is shown at the back of the turbine.

The plant has a rated output of 4½ h.p. on a 60-ft. fall when running at 1,300 r.p.m. Direct-current is generated at 220 volts by the dynamo, which has an output of 2.7 kW. A wiring diagram is shown in fig. 2.

Apart from the question of cheapness, the new governor has many advantages: It has only one moving part (the brake drum) and there are no sparking contacts, such as occur in other voltage regulators. It causes no wear on the turbine guide-blade mechanism, and the voltage regulation under sudden load changes is so good that no flywheel is necessary. Perhaps its greatest advantage lies in the fact that no variation in the water flow is caused by sudden load changes and, consequently, even with the longest pipelines, no water hammer is set up. Expenditure on relief valves, surge tanks, and other pressure regulators, can therefore be entirely avoided by its use.

The new form of governor described has already been used with great advantage in cases in which compensation water is being used to generate electricity. Another case in which its use is of particular service is for regulating the speed of high-specific-speed propeller-type turbines. As is well known, rapid corrosion of the runners of such turbines occurs if they are worked with part gate opening for any considerable length of time; by its feature of maintaining a constant load, this governor can avoid part-gate working altogether. In fact, there might be cases in which the movable turbine guide-vanes could be dispensed with altogether, with a corresponding substantial gain in simplicity and first cost.

The curve reproduced in fig. 3 shows the voltage regulation obtained on a small plant under varying load without any alteration of the various regulator positions, or of the turbine-gate mechanism. With the whole load suddenly thrown off, the momentary rise of speed was 8.5 per cent.; and with the whole load suddenly applied, the momentary drop of speed was 5 per cent.; in both cases the speed settled to normal in about 2 seconds.

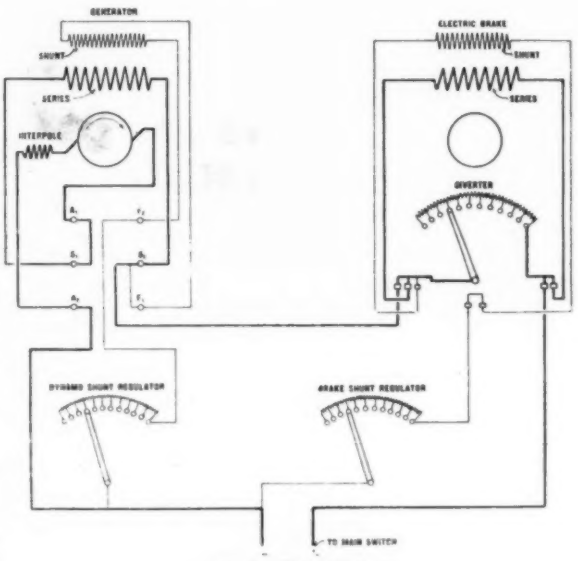

Fig. 2.—Wiring Diagram.

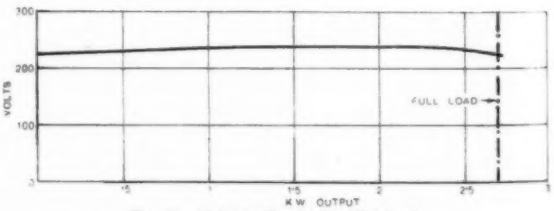

Fig. 3.—Voltage Regulation Obtained.

By a somewhat different controlling device the brake governor can be used to govern turbines driving alternators, or those carrying a purely mechanical load.

Time Switch Contracts.—The City of Copenhagen, which placed a contract with VENNER TIME SWITCHES, LTD., a few years ago for time switches for controlling the lighting of the main streets, has now placed a further contract with the company for extensions.

Electricity Supply at Liverpool.

Recent Extensions of the City Corporation's Undertaking.

EARLY in 1883 the Liverpool Electric Supply Co., Ltd., was formed to supply electricity in the central portion of the city. In 1896 the Company's business was purchased by the Corporation, which also acquired that of

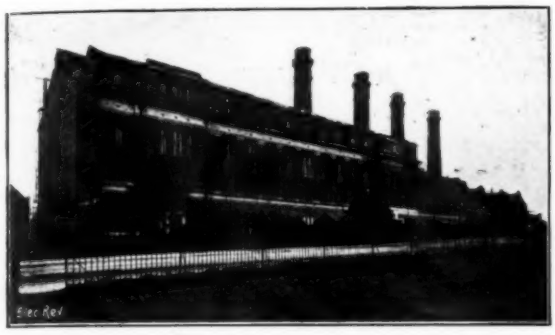

Fig. 1.—Lister Drive Power Station, Liverpool.

the Liverpool United Tramways and Omnibus Co. in 1897, electricity being generated at that date in four stations having a total capacity of 3,000 kW.

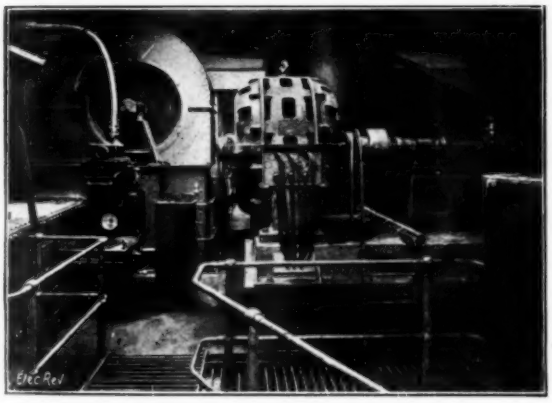

Fig. 2.—Part of Boiler Fan Room.

The building of new stations commenced at Pumpfields in 1899 and at Lister Drive in 1900, a modification in the latter case being the installation of 3-phase, 50-cycle, 6,600-volt, a.c. generators in place of the d.c. 500-V machines previously used, to enable generation to be concentrated at Lister Drive No. 1 and the older stations to be gradually converted to sub-stations. The next step in this process was the commencement of the erection of Lister Drive No. 2 station, which was equipped with vertical and horizontal steam turbo-alternators instead of high-speed reciprocating sets; when completed this station's capacity was 20,000 kW.

In 1911 the reconstruction of No. 1 plant was commenced, the total capacity of its a.c. and d.c. turbo-generators being raised to 33,000 kW, while in 1919 the reconstruction of No. 2 station was started, raising its capacity to 37,000 kW. The two combined were then capable of an output of 70,000 kW, which, however, soon proved to be insufficient, and a further extension had to be undertaken.

The new Lister Drive No. 3 station, fig. 1, which was officially inaugurated on July 26th, 1926, as is mentioned elsewhere in this issue, when completed will be capable of housing five sets of 25,000-kW each.

All coal is received by rail, and a reinforced-concrete silo (225 ft. long and of 1,000 tons capacity) has been so constructed that the 20-ton steel railway wagons are run over it and their contents discharged through their hopper bottoms; coal is stored on the site between parallel railway lines and recovered by travelling steam grab cranes. Two parallel rubber-belt conveyors run under the silo, and the fuel is fed on to them through doors operated by rack and pinion gear; these belts feed another system of belts, and the coal is raised up an incline to the boiler-house bunkers. The Dempster conveying plant will deal with 300 tons of coal per hour.

The boiler house, fig. 3, contains four Babcock and Wilcox and two Yarrow units, each capable of evaporating 60,000 lb. of steam per hour at a gauge pressure of 285 lb. per sq. in. and a total temperature of 700 deg. F.; each water-tube boiler is equipped with mechanical stokers and a superheater, Green economiser,

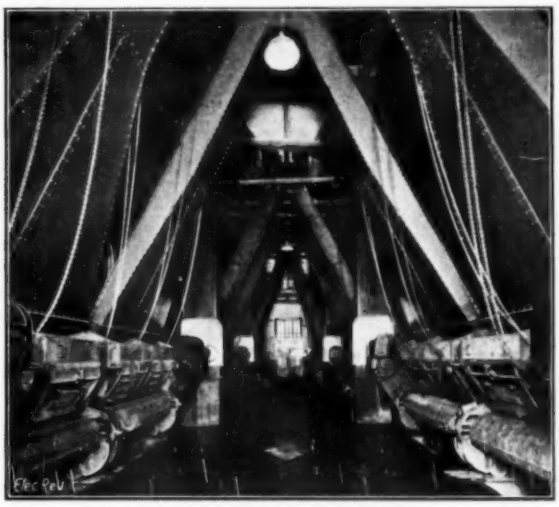

Fig. 3.—New Boiler-House Aisle.

air heater, Davidson forced- and induced-draught fans, chimney and grit collector, figs. 2 and 4. An "Express" passenger lift provides access to the five floors.

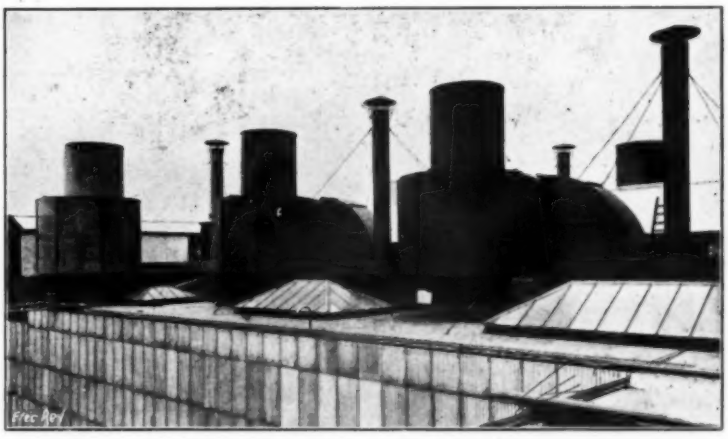

Fig. 4.—Chimneys and Grit Collectors.

The boilers are also equipped for burning oil, and tanks are installed having a storage capacity of 150 tons, fig. 5). The ashes are dumped from the hoppers

at the rear of the stokers into open pits fitted with water sprayers, whence they are removed by Jenkins dry-scraper conveyors working in troughs, delivering into skips which raise them into a reinforced-concrete bunker, whence the ashes can be loaded into either road or rail wagons. Combustible riddlings which fall through the chain grates are returned by means of hand wagons and a Spencer belt conveyor to the coal conveyor.

The present stage of the turbine house is shown by fig. 6. A railway siding runs into one end, and the Arrol travelling crane runs over this portion, which forms an unloading bay and is used as a workshop. The turbo-alternator has two cylinders and is of Metropolitan-Vickers manufacture, exhausting into a Weir condenser. The alternator is wound for 6,600 volts, three phase, 50 periods, runs at 1,500 r.p.m., is designed for a continuous load of 25,000 kW, but will carry 31,250 kW as overload for two hours. The exciter is directly coupled to the end of the alternator shaft, and incorporated in the same frame is a 375-kW generator that supplies the d.c. condenser auxiliaries.

The alternator is ventilated on the closed-circuit system, and the town's water make-up supply to the cooling towers is utilised in the air coolers.

The two-flow surface condenser has a cooling surface of 40,480 sq. ft. and contains 10,520 tubes, $\frac{3}{4}$-in. diameter. It is capable of maintaining a full-load vacuum of 27.5 in. when supplied with 1,400,000 gallons of cooling water per hour at a temperature of 83 deg. F., the barometer being at 30 in. The condensing water is circulated by two centrifugal pumps, one driven by a d.c. motor and the other by an a.c. motor; both pumps will normally run, in order to ensure continuity of supply, but either alone will handle over 800,000 gallons of water per hour.

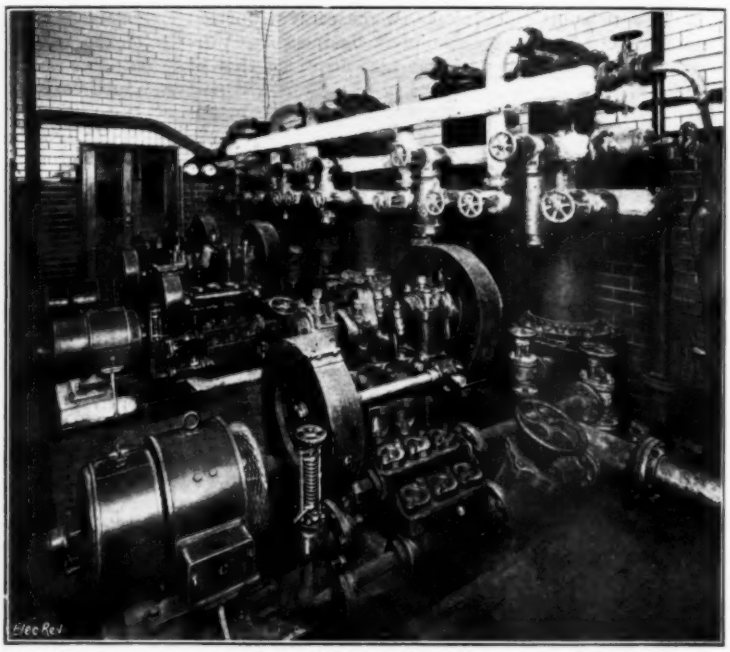

Fig. 5 Oil-fuel Pumps and Heaters.

The water-extraction pumps are also in duplicate, of the Drysdale vertical-spindle type; here also one is driven by a d.c. and the other by an a.c. motor. The a.c. and d.c. motors and d.c. controllers are of the M.V. Co.'s make and the a.c. controllers by Ellison. Air is extracted from the condenser by three sets of two-stage steam jet ejectors, the exhaust steam from which is led into surface heaters, through which passes the condensate on its way to the boiler feed pumps; two sets of ejectors will normally be required, the third being a stand-by. The condensate is also passed through a surface heater which obtains steam bled from the turbine near its low-pressure end, and by means of the various heaters the temperature is raised to about 150 deg. F. at the point of delivery to the feed-pump suction. The feed system is "closed" and a surge tank compensates for variations between the quantity of water discharged by the condenser extraction pumps and that required by the boiler-feed pumps.

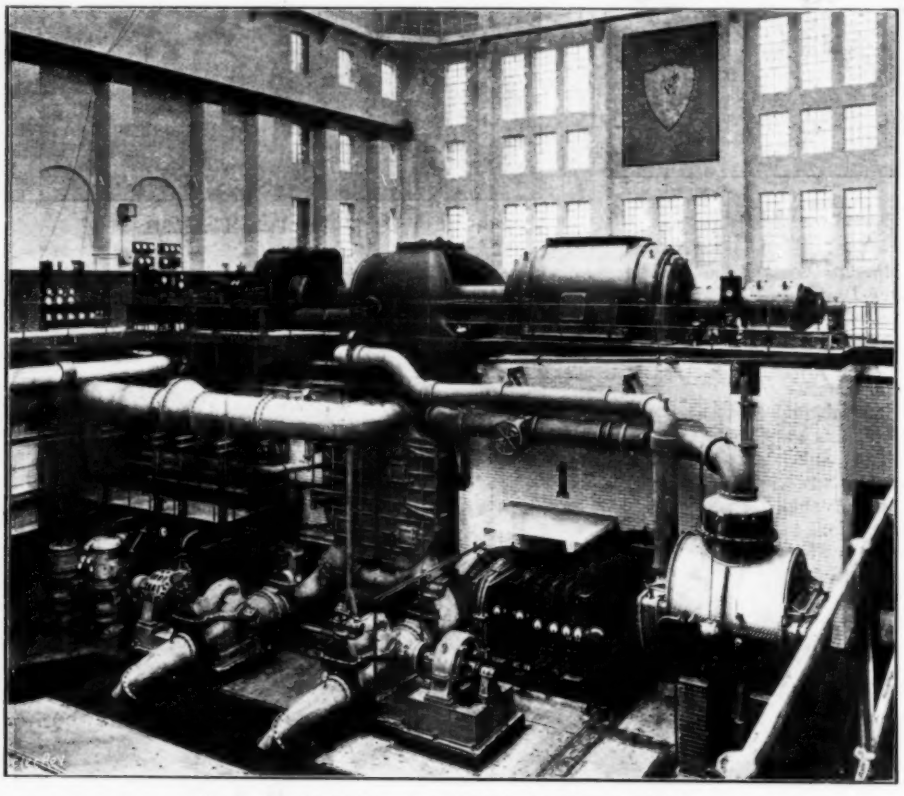

Fig. 6.—New Turbo-Generator and Condensing Plant, 25,000 kW.

The feed-pump room forms an annexe to the turbine house on the turbine platform level, which is also the firing-floor level of the boiler house. Four Mather and Platt, Pulsometer and two Weir pumps are installed, two of the a.c. motor-driven centrifugal type and two of the high-speed steam-turbo type. Of the former, one has a capacity of 13,500 gallons per hour at 3,000 r.p.m. and the other 27,000 gallons per hour at 1,500 r.p.m., while the Weir turbo pumps are

each of 27,000 gallons per hour capacity and fitted with a surface heater on the discharge side so that the exhaust steam may be utilised to heat the feed water. In order to reduce the possibility of scale trouble in the boiler tubes, the make-up water is all evaporated; the evaporator forms part of the condensing plant, and draws steam from the turbine near the low-pressure end for evaporating the "raw" water, the steam from which is returned to the main condenser and, being condensed, joins the main condensate supply. The condensed heating steam also joins the condensate system, and the sludge left from the "raw" water is discharged to waste by a special pump.

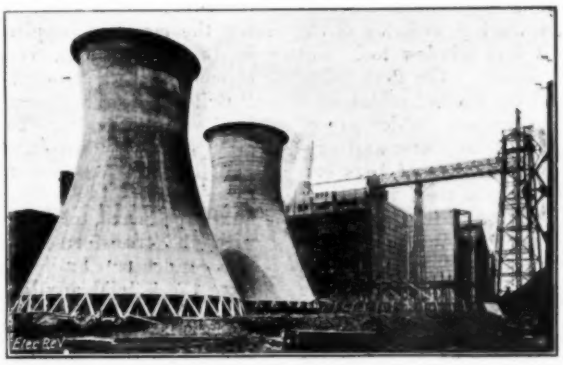

Fig. 7.—Condenser Water-Cooling Towers.

The cooling towers are of a type new to this country, being of a design which originated in Holland. The shells, fig. 7, are of reinforced concrete and the internal stacks (over which the cooling water falls) of timber. There are three towers in the present stage, each being 118 ft. high, 100 ft. diameter at the base, tapering to 42 ft. diameter at about two-thirds height, and opening out to 53 ft. diameter at the top. The total cooling capacity of the three towers is 1,400,000 gallons per hour; they were designed by Messrs. Mouchel & Partners, of London, and constructed by Messrs. Henshaw.

When the two 12,500-kW, 3,000 - r.p.m. turbo - alternators were installed, it was realised that the capacity of generating plant on the system had reached the limit of rupturing capacity of the high-voltage switchgear in the event of a fault, and that when any additional generating plant was installed it would be necessary to remodel the swichgear. A new switch-house has accordingly been built in front of the stations; at present it has six floors, and the Metropolitan-Vickers gear installed controls the 25,000-kW turbo-alternator, the alternators in the Nos. 1 and 2

Fig. 8.—Main Switchgear Control Room.

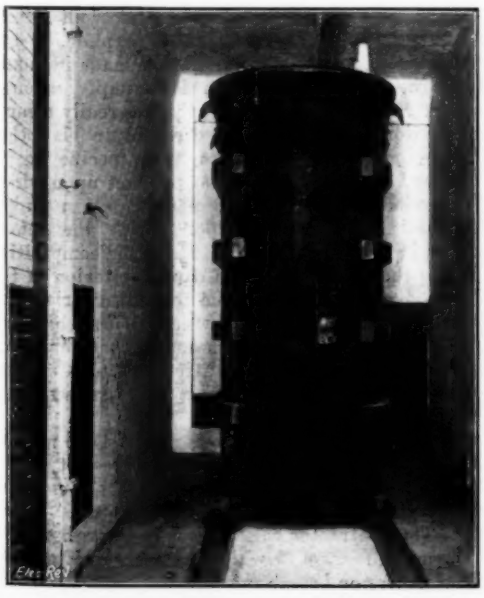

Fig. 9.—Step-up Transformer, 6,600/33,000 Volts.

Fig. 10.—Main Oil Switchgear.

stations, several new feeders, and all the existing feeders; the switches freed by the provision of the new gear will be utilised in the larger sub-stations.

The top floor of the switch house consists of the control room, fig. 8, from which all the h.p. switches of the three stations are operated. A bay window looks out into the No. 3 station turbine house. The floor below is utilised as a cable way for all the control cables, and the next floor contains the h.p. bus-bars, which are of the open type, separated by concrete barriers, and protected by sheet-iron doors: the four sets of bars can be coupled by reactors and a common tie-bar, so that full provision is made for the isolation of faulty feeders, also for laying off bus-bars for cleaning and inspection. On the floor below are the main oil switches, fig. 10, all solenoid operated from the control room through the intermediary of contactors. All switching is carried out on the 6,600-volt system, but several of the new feeders will work at 33,000 volts, step-up transformers being located in chambers below the switch floor, fig. 9; these are oil-immersed and forced-water cooled, the coolers and pumps being installed in a room below the transformer chambers.

Below the switch room, and on the same level as the transformer chambers, the works sub-station contains the h.p. works' switchboard, the motor generators for the d.c. supply to the condenser and other auxiliaries, and the step-down transformers for the a.c. supply for the condenser auxiliaries; also the main distribution board for the last two supplies. The two motor-generators, by the Electric Construction Co., are each of 500 kW capacity; there are six 250-kVA single-phase, air-cooled "British Electric" transformers, stepping down from 6,600 to 400 volts. The boiler-house fan motors are all of the a.c., 400-volt, three-speed, pole-changing type, and they are fed from two 1,250-kVA, 6,600/400-volt, three-phase, Metropolitan-Vickers transformers; the auxiliary board for distribution to the motors, together with the transformers, is situated on the fan floor. The condenser auxiliary d.c. motors can be fed either from the special auxiliary generator on the end of the main alternator shaft, or from the motor generators in the works' sub-station. The stoker motors are also d.c., and obtain their supply from the motor generators, but in case of emergency, all the d.c. auxiliaries can be fed from a large battery in the No. 1 station.

All the work has been carried out to the design and specifications of Mr. H. Dickinson, M.Inst.C.E., M.I.E.E., M.I.Mech.E., city electrical engineer, with the able assistance of his deputy and staff.

The Unit of Production.

Suggestions for Fixing a Reliable Costing Unit.

By E. G. ROSS, A.M.I.E.E.

Prominent in the public eye these days lies the vexed question of reducing the cost of production of all articles. Equally prominent is the prevailing vagueness as to the methods of making the reduction, and as to the necessary means by which the reduction is relatively compared. The attitude is not peculiar to the layman either. The production engineer himself is often guilty of vagueness in this important matter. The age is so accustomed to reckon everything in terms of £ s. d. that it becomes an apparently easy matter to reckon the selling price of an article in terms of production and *vice versa*. And so fallacies of many kinds arise daily.

The user, being the ultimate purchaser, calculates solely upon what it costs *him* to obtain the article, forgetting entirely that he does not produce it. Only in the most secretive "ring" materials does the final selling price come anywhere near to being a criterion of the cost of production, and even then the middleman's profit alters the relationship entirely.

Misunderstanding exists also in the minds of many makers. They usually ascertain, over a definite period, a fraction of the type: Total h.p. manufactured ÷ number of machines made, and take it for granted that this result is a true criterion of the state of their various factories. As a criterion it is, of course, useless. Demand is continually varying, and the factory oncost is varying also. Neither varies in any fixed proportion to the other, for an unbalanced factory is quite the usual occurrence, and therefore the unit so obtained can rarely represent the true state of affairs at any given time.

Also, since it is the function of good costing to give at any time a true criterion of the factory's condition, the result of such a fraction is valueless for costing purposes. Costs must meet market fluctuations in a continuous process to attain the ideal condition, and unless the basis upon which the costs are calculated is accurate, and very accurate, the attainment of the ideal is rendered the more impossible.

There is therefore need to consider if it is not feasible to adopt a unit which will fulfil the necessary conditions implied in the foregoing, and it should be noted as fundamental that any such unit can only be a money unit or a non-money unit, *i.e.*, a term of something produced. To the shareholder and financier the money unit is the easiest of comprehension, naturally. Money must make a return upon money, to them, and if it does not do so, production is said to be falling off or becoming dearer, or some such phrase. If a department shows an abnormal profit, its surplus is immediately set off against another department which has either made a loss or has just managed to clear itself, the ultimate result being that the final surplus is generally regarded as a criterion of the firm's prosperity, &c. Instead of being indicative of prosperity, this policy is indicative of the premium placed upon improper management and the incentive to do nothing. Clearly, the reverse position is really the true state of affairs. Any basis of comparison should be such as to compare truly positive results, not negative, and so the temptation to average is to be condemned in this very important sense.

It is perhaps needless to say that the ultimate power which regulates selling prices is the first market available for the goods concerned. Yet sometimes this is hardly fully realised by those who are affected most of all by first market fluctuation. The attempt to exploit a first market, for products of a similar nature made by many competing interests, is bound to fail simply through ignorance of what market control of prices really means. Each competitor puts forward his cheapest article (other things being equal, of course) to meet specific needs. That is to say, he puts forward that product upon which he has expended the fewest units of cost. On a purely impartial basis, that product upon which the fewest units of cost have been expended leads in the competitive race. Hence the first market is a direct criterion of the *cost* of a product, as distinct from its selling price. It is important to recognise the distinction, in which, of course, it is considered apart from any deliberate undercutting of profits. For equal conditions, the first market variation in any given product is a direct reflection of the cost of the product.

[By the term "first market" is meant that market for manufactured goods which takes no account of the middleman's profit. Thus a maker selling to a contractor, or through his own agent, is selling to a "first market." The contractor re-selling is here presumed to meet a "second market," which is not considered to be a criterion of cost.]

It is to be noted that the expression "units of cost"

does not mean pounds sterling. The cost of the article is expressed fundamentally in terms of hours worked, material, power, labour direct and indirect, and so on; and these through the usage of centuries have been reduced for convenience to equivalent money values; or, perhaps, as Spencer would put it, relative realities. The liability of error cropping up when money values are dealt with solely has already been noted, from the external point of view. The interior of the factory offers perhaps more possibility of such error than the outside. Oncosts must vary widely in every department involved in the production of a composite article, and, before costing began to assume the aspect of a science, oncosts difficult to reckon were simply spread over the whole production of the factory. In very many instances this is still a regular practice, particularly among these concerns which originally required enormous capital to commence business. The plant so capitalised at that time is largely out of date now, in that it is quite unsuited to the rush methods of to-day. The attempt to push cumbersome machinery designed for a multiplicity of purposes into producing a vast quantity of specialised articles must invariably lead to an heavy unbalancing of any factory. Simultaneous production of necessary components is more or less rendered impossible, and heavy accumulations occur in several places. Oncost is therefore very difficult of *continual* allocation, and can only be allocated in a spasmodic manner. Thus certain departments are considered to show a loss inherently, and others are thought to show an exceptionally good profit, and the averaging methods before mentioned are put into operation. Follows the unbalancing of the factory against market fluctuation, certain products believed to cost so much considerably undercutting the market, and so, in terms of production units expended, causing unsuspected but nevertheless real, loss to the producing factory; or other products may be thought to cost too much if they are unable to meet the market price, whereas their true cost may be considerably below the apparent cost.

The disadvantages of the money unit in this respect display that the true cost is really made up of units which are part of the thing produced, *i.e.*, non-money units. From which it follows that these units must vary with every factory concerned in the production of given articles. The variation is really relative, however, for the market itself represents the comparative number of absolute units of cost expended in definite instances, and the distinction here if unnoticed is liable to cause misapprehension of what follows.

It is the function of all good costing to balance the cost of production against the value of production. Apparently synonymous, these two terms are not identical, as every cost accountant knows, and it may be as well to re-define them here. Hazell, in his "Costing for Manufacturers," defines the *cost* of production as "the sum of *all* expenses incurred in any department over a stated period," and the *value* of production as "the number of units produced over the same period multiplied by the cost rates that have been established." To obtain the value of production, therefore, suitable cost rates must be obtained over the whole factory, *i.e.*, for every process undertaken in the factory. The estimating department must be kept well posted of any variations taking place in these rates, and this involves a considerable amount of labour on the part of the costing staff. Generally, indeed, it entails repeating the whole costing process for every change taking place. If this labour could be reduced after the first ascertainment or two, the working expenses chargeable to the costing department could be cut down considerably, and it would be therefore advantageous if the cost unit were such as to enable this to be effected.

From the foregoing, then, certain conclusions may be drawn. The unit of cost adopted should preferably not be a money unit; it must be integral with, and therefore part of, the final product; it must faithfully represent the factory conditions; it must offer the minimum possibility of error, and must therefore be a small part of the finished article. And a simple mutiplier only should be necessary to express the unit in terms of money for estimating purposes and general *external* comprehension.

In suggesting a costing unit to meet these desiderata, the reader's knowledge of accurate costing systems is presumed at least to the extent that he fully realises the amount of labour necessary to inaugurate any such system. The smaller the part chosen the less the possibility of ultimate error, since small mass-produced parts are susceptible of very accurate costing. However, except in factories in which they are made, one could hardly be expected to make use of nuts or bolts for costing purposes unless the shape and size of a bolt warranted, in its production from the raw material, the employment of several processes in the factory in which it was to be used. For, say, electric motor production, it is suggested that a simple part, such as a brush spindle, be taken. If it be flanged and machined all over, the processes involved in its production can be accurately costed in the ordinary manner without undue extra trouble. A wholly machined part is preferable in any event, for machine rates, comprehensive in every respect, represent pretty accurately oncost allocations of all kinds. (An existing costing system is presupposed, of course, preliminary labour in this respect, on ordinary lines, being essential.) Thus certain rates in the machine shop might be—

Auto lathe	5 £/*t*
No. 3 mill	2 £/*t*
Grinder (internal)	3 £/*t*

and so on, where t is the factory working time, and £ the money value of the costs chargeable in each instance over this time.

Suppose that 100 spindles are put through the auto lathe and that they take xt time to be produced. The cost per spindle is therefore $5\,xt\,£/100\,t = .05x£$. It is to be noted that x is not "hours," but a fraction dependent on the value taken in the first instance for t. This value will be the total working time estimated for the factory, and it is therefore seen that the cost as expressed, while nominally a money value, is in reality a strict denotation of all charges incurred in producing the spindles; or still more correctly, of all the responsibilities involved in their production. It is, of course, difficult to get away from the idea of money cost, but the money value is only obtained really by the employment of a conversion factor. x is a fraction of time, not money, and £ is not, as might be thought, the cost of the hours worked on the spindles, but the oncost of the factory taken over the time t (for each process).

At the outset, then, is obtained the conversion factor necessary for estimating and the external purposes of the factory. In this instance it is $.05\ x£$, which by appropriate substitution becomes a simple money value.

Essentially it will be inferred here that the first steps to be taken in fixing the unit are, that the *total* oncosts (*i.e.*, costs in the widest sense, including wages, everything) must be carefully ascertained (even the most primitive costing scheme can effect this); next, these costs must be very accurately allocated over the various departments (primitive systems cannot do *this* with much accuracy); and finally each set of costs must be subdivided carefully over each *process* in each department. (In certain instances total processes only need be considered, not necessarily each job.) Here, of course, painstaking care marks the road to successful achievement.

Suppose any process cost rate to be 6 £/*t*. If yt represent the time absorbed in the process, the cost of it in money units will be $6\,y£$. The number of the chosen production units in it will therefore be $6\,y£/.05\,x£ = 120\,y/x$. Since y and x are known for the conditions, this last reduces to a simple number only. Working from the general condition of the establishment as a whole to the specific processes carried on within it, the financial side of the production units expended is thus relegated to its proper sphere.

All processes in the factory being so reduced to terms of numbers, it is clear that the various parts of the business as a whole are represented in a form showing at a glance the economical (not in the cash sense) proportions maintained between them. In many instances, the com-

parisons will be surprising; nor will they be the less instructive for that.

Assuming production to remain constant, a decrease in cost will be reflected in the *lowering* of the departmental number concerned, and *vice versa*. And this is thought to be proper in that if the number is lowered, the improvement in production efficiency is the more easily perceptible to senses ever engaged in thinking of cost reduction in terms of money only.

With stable industrial conditions, the preliminary labour entailed in fixing the basis unit need only be repeated at very long periods. Labour, direct cost, and indirect cost in such an event generally vary but little. However, should any one of these change appreciably, the cost of the unit must be corrected accordingly. Labour cost and direct costs generally vary in jumps at long periods. Indirect costs usually vary slowly. Hence the *process* costs will reflect varying indirect costs to a greater degree than direct costs, since in the latter case the basis unit would be corrected to suit. A change in the method of production will be immediately reflected in the departmental numbers, and therefore a criterion is afforded of the advantage or otherwise of the change. Time, labour, and money variations can be adequately and expeditiously taken into account, and continually so if necessary. Factories are therefore in the fortunate position of being able without undue trouble to balance their outputs to meet market fluctuations. If the market is temporarily unbalanced, in that there exists a sudden demand for a certain type of apparatus, to the equally sudden exclusion of other types, then the production of the required type can be spread over the factory in a manner meet to keep the factory departmental load factor as conveniently high as possible, and so on.

Incidentally, the application of the overall bonus-on-output is rendered a comparatively simple matter. Many authorities regard this method of payment by results as the most satisfactory, in that unfairness between piece- and time-workers is, to a large extent, abolished. Here it is possible to combine the advantages of straight time payment, piece payment, and overall payment, since the first two can be employed in happy conjunction with the last. Process costs take account of the first two, and the third may follow independently. Suitable adaptations will commend themselves to the reader's mind. The main thing is that, whereas the *purely financial adjustments* can, and do, lead to a premium being placed on indolence, adjustments of the purely production unit lead directly to a premium being placed on the zealous worker. This is the requirement demanded by natural and healthy economic circumstances to which all the formulæ of true production are subject.

Correct estimating in the sales department is rendered comparatively simple. For each composite article produced, the cost is merely in the form of a simple addition of numbers. Local cost variations are simply taken account of by altering the departmental, or, it may be, part-list, numbers affected, and re-adding and converting. Hence there is no doubt in the estimator's mind about the possible effect of conditions with which he is not familiar. "Jumping" prices is more or less wiped out, with attendant benefit all round. If, as is often the case, two estimators at different times quote for the same work, the possibility of conflicting estimates being sent out is largely reduced.

Customers, especially regular ones, soon learn the effects of circumstances on suppliers' prices. If they can be taught tactfully that certain minor alterations affect prices only by "so-and-so," or *vice versa*, as the case may be, mutual confidence will be strengthened, and mutual sales policies harmonised. The use of production units on the basis suggested much facilitates this desirable end. Buyers therefore can design their own products in conjunction with other makers, and standardised manufacture is thereby carried a step further.

Moreover, buyers in general possess an uncanny omniscience of the maker's financial standing, and to them, the price at which they buy tells its own tale. The wideawake buyer is quick to appreciate the maker whose prices smoothly follow market and internal fluctuations. Strange it is that few manufacturers realise the far-reaching effects attendant thereon, for in the long run, or, it may be, short run, it must have its influence on shareholders. And if shareholders be taught that selling price *really* represents the market interpretation in terms of the factory's production, much misunderstanding will be avoided, confidence will be firmly established, and all-round stability effected.

The Ratio of Direct and Alternating Test Pressures.

By N. A. ALLEN, M.Sc. Eng.

THE following is the first of a series of four articles dealing with the subject of the tests which are applied to high-pressure cables after installation, so as to ensure that no damage has taken place during the process, and adopting direct current at a high potential as the testing medium in accordance with modern practice. The titles of other articles to appear in later issues will be:—

The Production of High-Voltage Direct Current for Cable Testing;

Testing Cables with High-Voltage Direct Current; and

Fault Location on Cables by means of High-Voltage Direct Current.

Introduction.

The development of electrical engineering during the last ten years has been marked by an unprecedented demand for the use of very high pressures for transmitting energy, in order to cover the long distances over which large amounts of power must be carried. This demand has been met by the introduction of transmission schemes by means of overhead lines at pressures up to 220,000 V. Where these lines must pass through or near cities it has become necessary, however, to adopt underground cables as the medium of transmission; the problem undertaken by cable makers has, therefore, been so to improve and perfect the methods of manufacture as to produce cables capable of working satisfactorily at voltages similar to those in use on open wire lines, and the result of research in this direction has been to develop paper-insulated cables which will operate at 66,000 V three-phase when the three cores are contained in one cable, and at 132,000 V three-phase when three single-core cables are used. It is not within the scope of this series of articles to discuss the manufacture or operation of the cables themselves, but rather to describe the tests which are applied to ensure the soundness of the dielectric after installation of the cable.

Necessity for Direct Current Tests.

In the days when 10,000 V was regarded as an optimum value of the working pressure, the most simple and satisfactory method was to apply a high potential test with alternating current at approximately double the working voltage. At the present time, however, bearing in mind the lengths of cable under test, this is not practicable owing to the heavy charging current taken by the cable. As an example, consider the size of the transformer which would be required to test a three-

phase 33,000-V cable twenty miles in length, having a conductor cross-section of .25 sq. in. The electrostatic capacity would be .36 microfarad per mile, and the a.c. testing voltage would be 66,000 V.

Charging $kVA = 2\pi f\sqrt{3}\ C\ E^2 = 17{,}000$.

It is manifestly impossible to construct a transformer of this kind in such a portable form that it could be used for the specified purpose.

On the other hand, consider the rating of the corresponding direct-current set, assuming the insulation resistance to be 100 megohm-miles and the d.c. testing voltage 100,000.

Charging $kW = E^2/R \times 10^{-3} = 2$ kW.

In other words, a 5-kW set is adequate to apply the requisite direct current voltage for testing long lengths of high-voltage cable; furthermore, the plant may readily be made portable.

Experimental Investigations.

There have been numerous attempts to arrive at a satisfactory working ratio between the direct-current and alternating-current voltages which will give an equivalent breakdown test of a dielectric. Various experimenters have carried out tests on different classes of insulation with widely divergent results. These divergencies appear to be due to the dissimilarity of the conditions under which tests were made. An examination of published literature on the subject as given in the bibliography at the end of this article reveals the following reasons for the differences in the d.c./a.c. ratio as measured by the various authorities.

1. The presence of moisture in any dielectric under test invariably lowers the d.c./a.c. breakdown ratio. The ratio measured therefore depends on the degree of moisture present in the dielectric, and this in some cases is not specified by the experimenter.

2. The time of application of voltage before breakdown occurs has an important bearing on the a.c. voltage which a given dielectric will withstand, while the effect of time is less marked with d.c. voltage. The ratio therefore depends on the duration of the test, and also on the rate at which the pressure is applied.

3. The thickness of dielectric has an influence on the measured ratio, since the a.c. voltage withstood per unit of thickness decreases rapidly with increasing thickness, while the d.c. voltage per unit thickness is approximately constant whatever the thickness. Thus the thicker the dielectric, the greater the ratio between direct-current and alternating-current breakdown.

4. In general, oils have lower ratios than solids. The presence of an oil in the dielectric, as in the case of paper-insulated cables, therefore, affects the result. Similarly, any other form of non-homogeneity has an important bearing on the measured ratio.

5. The effect of temperature has been stated to be important. Since tests have been normally carried out at the atmospheric temperature, differences have arisen from this cause.

Table I gives in a convenient form the conclusions as to d.c./a.c. breakdown ratio which have been arrived at by various authorities, and illustrates the diversity of opinion which at present exists. The reasons listed above suggest that if all the tests had been made under identical conditions, the divergencies would have been less marked, but nevertheless it does not appear to be possible to obtain any empirical relation which will apply, even under identical conditions, to all classes of insulating material.

TABLE I.

Dielectric tested	Condition	Ratios quoted by various authorities (Numbers refer to bibliography)									
		Laporte (2)	Lichtenstein (4)	Peek (6)	Weiset (9)	International Conf. 1921. (10)	A.C.E.C. (13)	Hayden & Eddy (14)	Dutch 1921 (16)	N.E.L.A. 1924 (17)	Rochow (19)
Air	Dry	—	—	1·41	—	—	1·27	1·41	—	—	—
Oil	Dry	—	—	1·41	—	—	1·33	1·30	—	—	—
Oil	Wet	—	—	<1·41	—	—	—	—	—	—	—
Petrolatum ...	—	—	—	—	—	—	—	1·35	—	—	—
Paper	Dry	—	—	—	2·41	—	1·78	1·55	—	—	—
Paper	Wet	—	—	—	—	—	<1·50	—	—	—	—
Paper	Impregated	—	—	—	—	—	2·83	2·50	—	—	—
Solids	Dry	—	—	Variable, *e.g.*, 3·5	—	—	—	1·45 up to 3·45	—	—	1·7
Solids	Wet	—	—	1·41	—	—	<1·50	—	—	—	—
Complete Cables ...	—	3 to 4	2·6	—	2·46	2·5	2·37 up to 2·63	—	2·0	2·0 up to 2·4	—
Rubber Insulated Wires	—	—	—	—	2·44 up to 2·51	—	—	—	—	—	—

Adoption of Standard Ratio for Cables.

Although the consensus of opinion adduced in published reports favours a ratio of 2.5 for paper-insulated cables, there are certain definite reasons which are likely to result in the adoption of a lower ratio than that indicated by the evidence produced up to the present time, namely:—

(1) Although the refinements of modern cable manufacture ensure that the percentage moisture left in the dielectric is very small indeed, yet it is impossible to remove the last traces. With an a.c. test, this moisture would remain evenly distributed through the insulation, and similarly under working conditions this would be true. With a d.c. test, however, the moisture would tend to migrate to the negative pole (electric osmosis) and the *proportionate* percentage of moisture would thus increase at this electrode. The effects of electrolysis, causing the generation of gases and local heating, would react unfavourably on the d.c. test, making it in practice more severe than it otherwise appears to be, in the case of paper-insulated cables.

(2) Referring again to the results of experimental tests which have been made with cable samples, the failure of such samples is frequently due to surges set up by spark discharges and corona at the exposed ends of the specimen under test. Since these phenomena are invariably more severe with alternating current, breakdown may therefore occur at lower a.c. voltages than the cable would withstand if the ends were efficiently protected. The ratio of d.c. to a.c. may therefore be higher when observed in this way than it would be under correct test conditions.

It is therefore suggested that a ratio between 1.5 and 2.0 be adopted. Since experiments indicate that as the insulation thickness increases, so the ratio increases, this suggests that up to 33,000 volts, say, the 1.5 value could be adopted, while above this the ratio should approach the limiting value of 2.0.

In this connection the figures given in Table II are of interest. This table shows the relative d.c. and a.c. test pressures which are usually adopted among British cable-makers at the present time.

TABLE II.

Working voltage.	Standard test a.c	Voltage d.c.	Ratio d.c. a.c.	Average thickness of dielectric.
11,000	20,000	30,000	1.50	.30"
22,000	44,000	75,000	1.71	.40"
33,000	66,000	100,000	1.52	.50"

Conclusions.

(1) The variety of conditions under which research has been carried out by different experimenters has been largely responsible for the diversity of the results which have been published.

(2) Modern practice favours a ratio of 1.5 between d.c. and a.c. voltages for pressure or breakdown tests on paper-insulated cables.

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(The author is indebted to the Editor of *Electrical Communication* for permission to use, in this series of articles, the subject matter of the above paper.)

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Swindon Corporation Bill.—On July 28th, on the third reading of this Bill in the House of Lords, Lord Banbury moved to insert a new clause to provide that "The Corporation shall be liable for all damage or loss sustained by a consumer with whom an agreement to supply current was in force arising from the Corporation having failed or neglected without reasonable excuse or having unlawfully refused to supply current to the consumer. The Corporation shall further be liable in any such case to a penalty not exceeding £50 per day for each day during which the default continues, and such penalty shall be surcharged on the members of the Corporation jointly and severally." Lord Banbury said that the local newspaper in Swindon was prevented from being published for two or three days during the general strike owing to the cutting-off of the electric current by the Corporation. The electricity supply was also cut off from a local laundry and one or two local manufacturers. The Swindon Corporation had informed him that its electricity department took this action without the knowledge of the Corporation, and that as soon as it was able to find men to replace the strikers, it had reinstated the supply of power. But he was told that the power was reinstated after Sir A. Griffith-Boscawen had informed the Corporation that if it did not do so, he would send down naval ratings and reinstate the supply. At least one member of the Electricity Committee was a member of the Strike Committee. There were 15 clauses dealing with electricity in the Bill, and the Corporation proposed to spend £300,000 on extending the electricity plant and works.

The Earl of Donoughmore, Chairman of Committees, maintained that such a matter should be dealt with by general legislation.

Lord Peel, First Commissioner of Works, said that the matter would be considered when the Electricity (Supply) Bill came before that House, and, on that understanding, Lord Banbury withdrew the new clause.

Impartiality in Broadcasting.—On July 27th, after answering questions relating to the ban placed upon the broadcasting of certain matters, Sir W. Mitchell-Thomson (Postmaster-General) was asked by Mr. Wright whether, in order to safeguard the impartiality of the broadcasting service, the representation of all sections of political opinion would be secured on the body that would conduct that service. He replied that he was not yet in a position to make any announcement as regarded appointments to the new organisation. The need for securing the impartiality of the broadcasting service would not be overlooked.

The Rugby Wireless Station.—On July 27th, Viscount Sandon asked the Postmaster-General what the geographical limitations were to the ability of the Rugby wireless station to reach ships at sea; whether he could give a list of the almost blind and the difficult spots for reception; and whether progress was being made in circumventing that difficulty.

Sir W. Mitchell-Thomson said that the most difficult localities for reception appeared to be in the eastern part of the Pacific Ocean between Honolulu and Valparaiso. The power of the transmissions from Rugby had recently been increased in order to facilitate reception in such difficult localities. All radio-telegrams sent from Rugby were transmitted twice, once during the day and once during the night; and experience showed that the messages were regularly and reliably received during one transmission or the other by ships in all parts of the world.

Trans-Atlantic Radio-Telephone Service.—On July 27th, Sir W. Mitchell-Thomson informed Viscount Sandon that there were still certain technical difficulties to be overcome before a trans-Atlantic wireless telephone service could be offered to the public, and no definite date could yet be fixed for the opening of such a service. Experiments were still proceeding, and until the results were known and experience had been obtained of the working of a trans-Atlantic service under commercial conditions, it was not possible to make any useful forecast concerning the possibility of extension to other countries.

Telephones.—On July 27th, Sir W. Mitchell-Thomson informed Mr. Day that the total number of telephones on the Post Office system working on June 30th last was 1,419,181.

Adjournment.—It was expected that Parliament would adjourn on Wednesday last until November 9th. If still necessary, it will be summoned monthly during this period to confirm the Emergency Powers Regulations.

Indian Electrical Trade in 1925-6.

(From Our Indian Correspondent.)

Imports of electrical machinery and goods into India during the year 1925-26 showed a satisfactory increase as compared with the previous year, and amounted in value to about Rs. 4¼ crores, as against Rs. 4 crores in 1924-25. The value of electrical machinery alone amounted to 222 lakhs, which was an increase of 20 lakhs. The principal increases were under transformers and turbo-generating sets. The imports of control- and switchgear amounted to 36 lakhs; generators and dynamos, 42 lakhs; motors, 34 lakhs; transformers, 18 lakhs; turbo-generating sets, 27 lakhs; and other sorts, 63 lakhs. There was a steady decline in the imports of motors. In 1923-24 these were valued at 72 lakhs; in 1924-25 they declined to 39 lakhs, and in the year under review to 34 lakhs.

The United Kingdom is, of course, the principal supplier of electrical machinery, her share representing 184 lakhs out of the total of 222 lakhs. It is also gratifying that this figure showed an increase over the previous year of about 8 lakhs. Next to her comes the United States with a share of about 20 lakhs, an increase of 5 lakhs over the previous year, but, compared with the year 1923-24, a decline of 20 lakhs. During the war years and subsequent to the Armistice, the United States established a hold on the Indian market, but with the revival of the imports from the United Kingdom her share dwindled. Yet she is holding out with considerable tenacity, and may even be able to increase her share over the present figure. Germany's portion, though small, is increasing rapidly, and during the year under review reached 9 lakhs from 4 lakhs in the previous year.

The imports of electrical instruments and apparatus amounted to 225 lakhs, as against 197 lakhs in the previous year. Electric fans rose in value from 25 to 28 lakhs, electric wires and cables from 66 to 77 lakhs, electric lamps from 15 to 25 lakhs, batteries from 7 to 9 lakhs, and electric lighting accessories from 14 to 16 lakhs. There were small decreases in the imports of telegraph and telephone apparatus, and also of unenumerated apparatus.

The bulk of the trade, as in the case of machinery, was secured by the United Kingdom, whose share increased to 151 lakhs during the year from 141 lakhs in the previous year. Germany and the United States of America stand next with equal shares amounting to 22 lakhs each. It may be noted, however, that while Germany's figure remained stationary as compared with the previous year, that of the United States showed an increase from 16 to 22 lakhs. Other countries, though their shares are small, all showed increases, the Netherlands from 7 to 8 lakhs, Italy from 5 to 7 lakhs, and Japan from 2 to 3 lakhs. The United Kingdom supplied 68 out of 77 lakhs' worth of electrical wires imported, 16 out of 28 lakhs' worth of electric fans, almost the whole of the telegraph and telephone apparatus, 8 out of 20 lakhs' worth of electric lamps, 9 out of 12 lakhs' worth of accumulators, 9 out of 16 lakhs' worth of lighting accessories, 4¼ lakhs out of 6 lakhs' worth of meters, 50 per cent. of the batteries, and 18 out of 29 lakhs' worth of unenumerated goods.

The imports of radio apparatus are recorded for the first time: they amounted to 6 lakhs, of which more than 4¼ lakhs' worth came from the United Kingdom.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Our Second Advertisement Competition.—Advertisers and their representatives who have not already sent in their applications for Entry and Authority Forms for our Second Advertisement Competition (see ELEC. REV., July 23rd, p. 140) are reminded that they can obtain copies of these forms, together with full particulars, by applying to The Competition Manager, The Electrical Review, Ltd., 4, Ludgate Hill, London, E.C.4.

Railway Charges for Electrical Machinery.—On July 29th, the Railway Rates Tribunal further considered the question of freight charges for iron and steel products. On behalf of the iron and steel manufacturers, Mr. F. G. Thomas, K.C., said that the railway companies were not guaranteed a standard revenue under the Act; they could not enforce charges which the traffic would not bear, and their success was dependent upon that of the industries of the country. Mr. Pinder appeared for the British Electrical and Allied Manufacturers' Association, and called witnesses. The first, Mr. A. R. Polson, said that while the companies' proposed scale would ease the burden of the present heavy surcharge, complete generating sets would be further burdened. The act of bringing electric locomotives and other items into the scale would have the effect of sending the orders for those machines abroad. He maintained that the rates proposed were far too high, and quoted instances in which the carriage of machinery had been charged for at unduly high rates; if that continued, manufacturers would be bound to consider alternative methods of transport. In conclusion, Mr. Polson said that generally electric locomotives weighed about 90 tons each, and were shipped in parts weighing 30 tons. Steam locomotives were not subjected to the surcharge which electric locomotives had to bear.

The Canadian Radio Industry.—The production of radio sets, parts, and batteries in Canada during 1925 reached a total value of $5,548,659. Six firms were engaged solely in the manufacture of sets and parts, while nine other firms combined this activity with the manufacture of general electrical apparatus. The figures show a large expansion. A total of 48,498 complete sets were manufactured, valued f.o.b. works at $2,196,024. The production of valves amounted to $1,299,684 in value and 940,498 in number, or double the previous year's output. Receiving licences were issued to 134,485 persons during the year. Licensed broadcasting stations numbered 55 (exclusive of amateurs), distributed as follows:—Ontario, 24; British Columbia, 10; Saskatchewan, 7; Alberta, 6; Quebec, 4; Manitoba, 2; New Brunswick and Prince Edward Island, one each.—*Reuter's Trade Service* (Ottawa).

Irish Free State Electrical Imports.—The imports of electrical goods, excluding machinery, into the Irish Free State during May last, amounted to a value of £16,159, as compared with £35,642 in May, 1925. The imports for the first five months of the year are officially returned at £175,658, as against £134,836 in the corresponding period of 1925.

A Middlesbrough Contract.—The Middlesbrough Town Council was asked by its Electricity Committee on July 27th to approve a recommendation regarding a new generating station, which read: "That the amended tender of the General Electric Co., Ltd., at the price of £131,800 be accepted, subject to the sanction of the Electricity Commissioners being obtained to proceeding with the work." Coun. J. W. Brown objected to the terms of the resolution, considering that, if the Electricity Commissioners agreed, the Corporation would be irrevocably tied to the General Electric Co., Ltd., when there was one local tenderer whose figure was only £1,000 above that of that company's. He thought the local firm should have a chance, and moved that the matter should be referred back. This was seconded, several members remarking that it was a mistake to commit the Corporation to one particular tenderer at that stage. Ald. Sir Joseph Calvert, chairman of the Committee, said that the tender of the General Electric Co., Ltd., was accepted as long ago as last December. It was the only responsible firm which had given guarantees of the price at which its plant could produce electricity, and it was prepared to accept a penalty clause. The Corporation's relationships with the Cleveland and South Durham Power Co. had always been most cordial, but he had no sentiment except in using the town's money to the best interests of the town. Therefore, if they could generate energy more cheaply, they should do it. They would not add a penny to the rates, as provision was made for redeeming the capital as they went along. The proposed new station would generate all the electricity Middlesbrough wanted and save the town £5,000 a year, while all that was spent on machinery would be cleared in 20 years. The Council accepted Sir Joseph's statement, and agreed to the recommendations, provided it was stipulated that, after the matter had been before the Commissioners, the Town Council should still have the right to say whether the work should be proceeded with or not.

Morecambe Council and Local Contractors.—Further to our last week's note on this subject, it is reported that the Electricity Committee has now agreed to receive a deputation from the local branch of the Electrical Contractors' Association, in connection with the Electricity Department's alleged trading in electrical fittings.

Unemployment in Germany.—The Berlin correspondent of *The Times* states that the German unemployment returns for July 1st showed a total of 1,741,000, a slight reduction from the previous month's figure. A larger decrease is expected owing to improvements in various industries and the employment to be afforded by public relief works.

Social Events.—The General Electric Co.'s travellers' outing, an annual event, which was celebrated recently, took the form of a river trip from Staines to Maidenhead. A large party had a thoroughly enjoyable day. Mr. M. J. Railing, general manager and director of the company, one of three

G.E.C. Travellers on the Thames.

directors present, reminded the party of an outing in 1894 to Monkey Island, when the entire staff of the company totalled only as many as the particular section who were taking their outing that day.

The first annual sports meeting of the Union Cable Sports and Social Club was held on the club's ground at Dagenham on July 17th. The fine weather drew a large attendance. The prizes were presented by the club's president, Mr. J. Snow Huddleston. Mrs. Huddleston was presented with a bouquet by Miss D. Saxton on behalf of the club members.

Hungarian Industry in 1925.—In a Department of Overseas Trade report (Stationery Office, 1s. 6d. net), Mr. E. C. Donaldson Rawlings, Commercial Secretary at Budapest, says that the year 1925 was the worst for the Hungarian iron and machinery industries since the end of the war. In May of that year the output was 35.5 per cent. less than the full capacity of the works. Certain sections were, however, not so badly affected, and amongst these were the h.p. electrical equipment factories (producing motors, dynamos, &c.), the l.p. electrical works (telephone, telegraph and signalling apparatus), and the factories producing household articles. Many of these reached a record production in spite of the slackness of trade.

Referring to general trade, Mr. Rawlings says that although the value of British trade is relatively small, it is showing a rapid increase which is likely to continue, for not only are British goods known in Hungary as the best value for money, but British merchants and travellers enjoy a special welcome in the Hungarian market.

Unemployment.—There was a slight decrease in the total of unemployed persons during the week ended July 19th, the number at that date being 1,631,300, as compared with 1,644,194 on July 12th, and 1,221,912 on July 20th, 1925.

Deed of Assignment.—R. G. CRONYN, trading as the "RADIO SETS & SUPPLIES CO.," 3, King Street, Maidenhead.—Particulars of claims to be sent to the trustees, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2, and Mr. C. Latham, 78, New Oxford Street, W.C.1, by August 9th.

Winding-up Petition.—GWYNNES ENGINEERING CO., LTD.—A petition for the winding up of this company was presented to the High Court on July 27th, by Mr. N. G. Gwynne; it will be heard on October 13th.

Industry and the Coal Dispute.—The Federation of British Industries reports that the most remarkable feature of the present situation is the way in which the industries of the country, taken as a whole, appear to have succeeded in adjusting themselves to the new condition of affairs. There has been no general collapse, as was anticipated in many quarters, nor do there appear to be any signs of a progressive deterioration of the position. The rapidly-increasing importation of coal, accompanied by a marked improvement in railway facilities, points to a reduction of the economic pressure rather than to the reverse. Even in the case of the heavy industries which have had to face the full force of the disaster, there has been in certain of the finishing sections a limited resumption of operations. The new equilibrium position at a reduced level of production to which trade appears to have settled down is reflected in the unemployment figures, which have remained almost unchanged for more than a month. How long this state of affairs can continue it is difficult to say. While there is no reason for anticipating any immediate worsening of the situation, the high prices and poor quality of the imported coal make it unlikely that there will be any very appreciable re-absorption of the unemployed into industry until the Home production of coal is resumed on a substantial scale.

A Joint Radio Publicity Scheme.—The accompanying illustration depicts a motor van which is touring the West of England on behalf of the Mullard Wireless Service Co., Ltd., Messrs. Alfred Graham & Co., Ltd., and Automobile Accessories, Ltd. The object is to promote the sales of the

Propaganda by Motor Van.

companies' principal productions—"P.D." receivers, "Mullard" valves, and "Ampiion" loud speakers. Prior to the arrival of the van in a district, an advance agent arranges window displays by local retailers, and the town is well billed to announce the van's arrival. During the van's stay, broadcast concerts are arranged and collections are made for local charities.

Trade Announcements.—The telephone numbers of the Scott Insulated Wire Co., Ltd., are now "North 2408 and 3409."

Messrs. G. E. Wallis & Sons, Ltd., have taken over the business of Messrs. Oswald Jones & Co., electrical engineers, Ashford, Kent.

The Newman Electrical Co. has removed from Newman Street, W.1, to 23, Percy Street, Tottenham Court Road, W.1. Telephone: "Museum 5319"; telegrams: "Nulecspli, Westdo, London."

Simplex Conduits, Ltd., informs us that Mr. J. Huntingdon, superintendent of sales of its London and South of England branch, has been appointed manager of that branch; also that Mr. J. Entwistle, manager of the Manchester branch, has taken over control of the north-western area comprising the Manchester and Liverpool branches. The appointments date from August 1st.

Catalogues and Lists.—Electradix Radios, 218, Upper Thames Street, E.C.4.—An illustrated and priced catalogue of radio apparatus, &c. (68 pp.).

Messrs. Hathorn, Davey & Co., Ltd., Dewsbury Road, Leeds.—A brochure dealing with pumping and hydraulic machinery.

The Electric Construction Co., Ltd., Bushbury Engineering Works, Wolverhampton.—An illustrated descriptive catalogue relating to rotary converters, and a pamphlet dealing with the company's electro-magnets for braking, &c.

Messrs. F. Turner, 61-63, Summer Hill Street, Birmingham.—A priced and illustrated catalogue of art-metal mantel pieces and surrounds.

St. Helens Cable & Rubber Co., Ltd., Slough.—A booklet dealing with wiring with "C.T.S." cable, and another containing a list of contracts carried out on this system.

Venner Time Switches, Ltd., 45, Horseferry Road, S.W.1.—List No. 31, illustrating and describing the "Venner" current limiter.

Messrs. L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.—A folder advertising the "Kelvinator" electric refrigerator.

Messrs. Hans Renold, Ltd., Burnage Works, Didsbury, Manchester.—An illustrated booklet containing prices and particulars of chains for industrial applications.

Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2.—Two pamphlets—one (supplementary to Leaflet No. 1,053) dealing with the type "R.g.6s" receiver, and No. 1,058, illustrating and describing a frame-aerial direction finder, type "11 F."

Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.—A blotter for August illustrating an "M. & C." shaker-conveyor.

The Trelleborg Ebonite Works, Ltd., Audrey House, Ely Place, E.C.1.—A circular containing prices of ebonite panels for radio work.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—August blotter announcing reductions in the price of "Jackson" wash-boilers.

Pope's Electric Lamp Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.2.—August blotter advertising "Elasta" lamps.

Bankruptcy Proceedings.—A. Pacy, J. Pacy and R. Feitelson (trading as the Comton Wireless Mfg. Co.), 26-28, Bartholomew Square, E.C.—The public examination of these debtors was appointed to be held on July 27th before Mr. Registrar Mellor, at the London Bankruptcy Court. The receiving order was made on their own petition in June, and accounts have now been furnished showing total liabilities £3,134, of which £2,552 is expected to rank against assets valued at £1,407, after deducting £105 for payment of the preferential claims. Mr. Armstrong, Official Receiver, reported that the statement of affairs had only just been lodged, and further time was required for purposes of investigation. By general consent the examination was adjourned until November 9th next. The following are the principal creditors:—

	£		£
Unsecured.		Weber & Fluck (Switzerland) ...	107
Ebonestos Insulators, Ltd. ...	102	Franklin, T. H., & Co.	171
Davis & Timmins, Ltd.	167	Smith & Sons	120
Spears & Co.	88	Trader Publishing Co., Ltd. ...	53
Fahr & Co. (Switzerland) ...	340	Samuels, A. E., & Co.	249
Creasey, Geo., & Sons	23	Scadding & Bodkins	53
Lowenadler, F. W.	540	Freeman, A.	81
Crystalate Mfg. Co., Ltd. ...	122	Fully secured.	
B.D. & Co. (Edward A. Boynton)	68	Westminster Bank, Ltd. ...	136
Robinson & Sons, Ltd.	52	Barnard & Crannis, Ltd. ...	40
Barrel Polishing & Plating Works	22	Franklin & Freeman	405

J. H. Dollittle (trading as "The Zenith Radio Manufacturing Co."), Guildford, radio engineer.—Receiving order made July 22nd on debtor's own petition.

J. R. Barker, Front Street, Pontefract, and 183, Kirkgate, Wakefield, radio dealer.—First and final dividend of 3s. 8½d. in the £, payable at the Official Receiver's office, 21, King Street, Wakefield.

M. Kelly, 12, Jackson's Row, Manchester, radio apparatus dealer.—Last day for receiving proofs for dividend August 11th. Trustee: Mr. J. F. Warburton, 28, Queen Street, Manchester.

L. A. Woodhead (trading as L. Woodhead), 25a, Charles Street, Bradford, radio dealer.—First meeting to-day (Friday) at the Official Receiver's Office, 12, Duke Street, Bradford. Public examination August 9th, at the County Court, Manor Row, Bradford.

H. P. Jackson, cycle and wireless dealer, 70, Micklegate, York.—First meeting to-day (Friday) at the Official Receiver's Office, Duncombe Place, York. Public examination, September 3rd at the Law Courts, Clifford Street, York.

H. G. Sellers (trading as R. Sellers), 72a, Spital Hill, Sheffield, electrical engineer.—First meeting held August 4th. Public examination, August 19th, at the County Court Hall, Bank Street, Sheffield.

A. B. Hawkins and H. Hawkins (trading as Hawkins Bros.), electrical engineers, 101, Station Hill, Kidderminster.—Receiving order made July 24th, on debtors' own petition.

J. B. Shields, plumber and electrician, 221, Linthorpe Road, Middlesbrough.—Trustee, Mr. C. P. Barrowcliff, 55, Albert Road, Middlesbrough, released July 13th.

N. L. Crawley, electrician, 90, Three Colt Street, E.14.—Receiving order made July 27th, on a creditor's petition. First meeting, August 13th; public examination, October 20th; both at Carey Street, W.C.2.

H. Robinson, radio and cycle dealer, 41, Wigan Lane, Wigan.—Receiving order made July 26th, on debtor's own petition.

D. E. Davies, radio engineer, 19, Poulton Street, Kirkham, Lancs.—First and final dividend of 3s. 1½d. in the £, payable at the Official Receiver's offices, 11, Winckley Square, Preston, August 6th.

Company Liquidations.—H. E. Davis, Ltd., electrical engineers, 4, South Street, E.C.—A compulsory winding-up order was made against this company on May 11th, and the first meetings of the creditors and shareholders were held on July 27th at the Board of Trade Offices, Lincoln's Inn, W.C. A statement of affairs was lodged showing total liabilities of £6,974, assets valued at £2,241, and a deficiency of £5,734 with regard to contributories, the issued capital being 1,002 ordinary shares of £1 each. Mr. G. D. Pepys, Official Receiver, reported that the company was registered as a private company on November 17th, 1924, with a nominal capital of £2,000 to acquire as a going concern the business of electrical engineer formerly carried on by Mr. H. E. Davis, and to carry on the business of wireless contractors, importers, exporters, and general merchants. It carried on business as The Golders Green

Radio Stores. The directors were Mr. Davis and Mrs. M. C. Lawrence. For some years prior to the formation of the company, Mr. Davis had carried on business as an electrical engineer at 4, South Street, E.C. Owing to the incompetence of his manager, and to heavy establishment expenses, the business did not pay, and he eventually decided to convert it into a private limited company with the object of obtaining capital from friends. Mr. Davis was, however, unsuccessful in his efforts to obtain subscriptions. Under the purchase agreement, dated December 2nd, 1924, the company agreed to discharge existing liabilities amounting to £560, and gave the vendor a debenture for £2,000, and shares to the amount of £1,000, the assets being valued at £3,560. Working capital was obtained by realisation of the book debts, and, in addition, advances were made by the bankers, who were creditors for £268. On April 12th, 1926, Mr. W. A. J. Osborne, accountant, was appointed receiver and manager for the debenture holder, no interest having been paid on the debenture. On the same day an extraordinary resolution was passed for voluntary winding up, and Mr. R. S. Yates, C.A., was appointed liquidator. Later a meeting of creditors passed a resolution for compulsory liquidation. Mr. Davis attributed the failure of the company to depression in the wireless trade and to heavy establishment expenses. The Official Receiver was of opinion that the amount of remuneration drawn by Mr. Davis was excessive and unjustified. It appeared that Mr. Davis was to receive £25 a week, and any expenditure he might incur whilst on the work of the company. On July 15th, 1925, it was resolved that in consideration of Mr. Davis not drawing any salary during the depression period, he should be handed a debenture for £500, which had been issued to him by Discamusements, Ltd., prior to the formation of the company and taken over by the company amongst the assets of the business, so that as and when the debenture was paid he should receive the money on account of salary. According to the company's records, Mr. Davis drew £130 salary and £124 for expenses up to July 15th, 1925, and in spite of the resolution then passed, he subsequently drew £695 for salary and £108 in respect of expenses. The liquidation was left in the hands of the Official Receiver. The following are the principal creditors:—

	£		£
Acme Showcard Company ...	81	Kettle, H. E.	22
Autoveyors, Ltd.	56	Lee & Churchill	53
Beaver Electric Co.	106	Lee, A.	257
Bretwood, Ltd.	106	Lloyds Bank, Ltd.	268
Burndept, Ltd.	118	Mercure (Paris)	32
Burton, T. H.	48	Milton Accumulators	24
Chanot & Co.	21	North London Eng. Co. ...	24
Collinson's Precision Co. ...	40	Naylor, J. & H.	25
Crypto Elec. Co., Ltd.	44	Phillips Lamps, Ltd.	41
Discamus-ments, Ltd.	473	Peters, S.	20
Duicker, J.	38	Pass, V. V.	28
Dickinson Mfg. Co.	54	Rothermel Radio Corpn., Ltd.	131
Electron Co., Ltd.	27	Redfern, G. F., & Co.	41
Empire Elec. Co.	34	Radio Equipment Co.	40
Ferranti, Ltd.	26	Radi-Arc Electrical Co. ...	37
Goodale & Co. (Hamburg) ...	1,019	Sage, F., & Co.	81
Hardwareman and Builders' Merchant	33	Spillar, S. A.	97
Hurley Machine Co.	65	S.D.H. Mfg. Co.	43
Hirst Bros. & Co., Ltd. ...	76	The Scott Insulated Wire Co. ...	30
Hunt, A. H., Ltd.	29	Wireless Components Co. ...	52
H.M. Stationery Office	25	Wholesale Wireless Co. ...	20
Igranic Electric Co., Ltd. ...	39	H. E. Davis	75

NORTH AND WEST FACTORS, LTD., radio factors, &c., 31, St. Clements, Oxford.—A meeting of creditors was held on July 29th at the offices of the Wireless and Radio Trades Guardian Association, 78, New Oxford Street, W.C. The chair was occupied by Mr. C. Latham, the liquidator of the company, who submitted a statement of affairs which disclosed liabilities of £3,856 and net assets of £1,211, leaving a deficiency of £2,645. Two of the directors of the company were cash creditors for £900, one of whom (Mr. G. D. Adams) advanced money just before the liquidation to pay off the overdraft at the bank which he had guaranteed. The company was registered on November 30th, 1922, with a nominal capital of £2,500 in £1 shares. It was formed to take over a business previously carried on by Mr. Henry Blomfield. The purchase price (£1,650) was satisfied by the allotment of fully-paid shares. In February, 1923, further capital was required, and Mr. Adams came into the company, providing £500 for shares, and joining the board. The trading of the company had always resulted in a loss. The directors attributed the present position to the heavy losses sustained by the company in its earlier years, losses of between £400 and £500 of stock, heavy depreciation, falling prices, and decreased turnover owing to the industrial position. A resolution was passed confirming the voluntary liquidation of the company with Mr. Latham as liquidator. The creditors include the following:—

	£		£
Ashby, F., & Co.	20	Metro-Vick Supplies Ltd. ...	64
Bayliss, Wyley & Co.	27	Mackintosh, C., & Co., Ltd. ...	72
Brandes Ltd.	57	North British Rubber Co., Ltd.	45
Ever-Ready Co., Ltd.	27	Stephens & Co., Ltd.	124
Lee, Alfred, & Co., Ltd.	25	Stephens, J. A., Ltd.	23

LIVERPOOL ELECTRICAL ENGINEERING CO. (1923), LTD.—A general meeting is to be held at 70, Central Buildings, 41, North John Street, Liverpool, on August 30th, to hear an account of the winding up by the liquidator, Mr. C. Hodgson.

FRANK CRAFT (CASTLEFORD), LTD.—Mr. G. G. Poppleton, 25, Corporation Street, Birmingham, was appointed liquidator, with a committee of inspection, on June 29th.

STEVENS PETROL-ELECTRIC VEHICLES, LTD.—A meeting of members is called for September 1st, at Ulster Chambers, 168, Regent Street, W.1, to hear an account of the winding-up by the liquidator, Mr. W. Shaw Hopking.

BRITISH AUTOMATIC TELEPHONE INSTALLATION CO., LTD.—Winding up voluntarily. Liquidator, Mr. J. Mangles, 4, Theed Street, Roupel Street, S.E.1.

BRITISH RADIOPHONE, LTD.—A general meeting of members is to be held on September 7th at the offices of Messrs. Morton, Moller, Sheen & Co., Capel House, New Broad Street, E.C.2, to hear an account of the winding-up by the liquidator, Mr. R. C. Sheen.

MAYWOOD ENGINEERING & ELECTRICAL MANUFACTURING CO., LTD.—Particulars of claims to be sent by August 23rd to the liquidator, Major L. Russell-Wood, 29, Essex Place, Chiswick, W.4.

Private Arrangements.—GOODCHILD, CHAPMAN & CO., 357, High Road, Wood Green, N., electrical engineers, &c.—A meeting of creditors was held on July 26th at the offices of Messrs. Mills, Lockyer & Co., solicitors, 29, Finsbury Square, E.C., when the chair was occupied by Mr. Evill. The chairman stated that he had been consulted owing to an execution which had been levied, and other legal proceedings which had been commenced. A detailed statement of affairs had not been prepared, but the liabilities were in the neighbourhood of £691, included in which was an amount of £173 lent by the stepmother of Mr. Goodchild. The bank was a partly-secured creditor for £131, and held as security a life policy, the surrender value of which was estimated at £50. The assets consisted of: Stock-in-trade at cost, £430; plant and fixtures, £80; good book debts, £15. Mr. Goodchild commenced business in 1919 with £200 capital, taking in Mr. Chapman as a partner; Mr. Chapman left the concern some time ago. The present position was attributed to losses in connection with wireless goods, and pressure by creditors. The solicitor intimated that a lady was prepared to guarantee a composition of 7s. 6d. in the £, payable by equal instalments of 11¼d. in the £ per quarter, to be payable out of any future earnings of the debtor. The creditors decided to appoint a representative to inspect the stock and report to a later meeting.

At the adjourned meeting of creditors on July 30th, Mr. P. Houston said that his clients, the General Electric Co., Ltd., had inspected the stock, and considered the value to be £150. They knew nothing with regard to the plant. A creditor said that he had understood that the stock was worth £480 and the plant was estimated to realise £80. Mr. Houston said that the General Electric Company's representative said that the gross value of the stock was £500, but it could not be expected that anything like that amount could be realised. The other assets amounted to £15. The solicitor who represented the debtor, said that he was not instructed to make any other offer than was put before the creditors at the last meeting, which was 7s. 6d. in the £ spread over a period of two years, and consequently there was no alternative but for the debtor to file his own petition. Subsequently, the solicitor withdrew this, and said that the lady who was prepared to find the money to pay the composition would endeavour during the course of the next few days to find security to pay the creditors a composition of 5s. in the £. The largest creditor said that if 5s. in the £ was forthcoming, his firm would be prepared to accept it. It was therefore decided to adjourn the meeting again in order that security might be found to pay a composition of 5s. in the £ to the unsecured creditors.

Dissolution of Partnership.—FARQUHAR & HEYS, electrical contractors, Blackburn.—Messrs. J. Farquhar and J. Heys have dissolved partnership. Debts will be attended to by Mr. Heys, who will continue the business.

Conditions in Roumania.—A list of goods required by Roumania, in which there are openings for British producers, is contained in a report recently forwarded to the Department of Overseas Trade by Mr. R. J. E. Humphreys, Commercial Secretary at Bucarest (Stationery Office, 2s. net). The list includes electrical machinery, apparatus and fittings, cables and wires, and radio apparatus. In these lines competition is met with from Germany, Austria, Hungary, Czecho-Slovakia, and France. For British firms doing, or intending to do, large business in Roumania, the safest and most profitable method is to have their own selling firm registered there and their own resident representative to act for them. It is also advisable to hold stocks in the country, a practice adopted by competing foreign firms. Failing direct selling methods, it is essential to appoint a reliable local agent. More attention might be paid to advertising in the local papers, and publicity matter should be printed preferably in Roumanian or French, as well as in English. The instability of the currency is a handicap, and yet reasonable credit is expected. With regard to railway contracts, it is necessary for tendering firms to be registered at the Roumanian Railway Administration. In this connection it may be mentioned that the electrification of certain lines is contemplated. An appendix to the report by Mr. T. B. Wildman, vice-consul at Constantza, states that it is probable that the electric lighting and tramway concession for that district will again be offered, but in a form more acceptable to foreign firms. In the Banat district, according to the vice-consul at Timisoara (Mr. S. Szana), the Siemens-Martinstahl works has taken up the production of electrical machinery which is ousting German and Bohemian products.

Book Notices.—"Calendar of the Loughborough College, Session 1926-27." Loughborough: The Echo Press. Price, 2s. 6d. net.

"The World Race for Trade: Britain's Chance." London: United Newspapers (1918), Ltd. Price, 6d.—This pamphlet contains reprints from the *Daily Chronicle* of a number of articles by special correspondents who have travelled in America, France, Belgium, Holland, Germany, Italy and Spain.

"Science Abstracts" (A and B). Vol. XXIX, Part 7. July 25th, 1926. London: E. & F. N. Spon, Ltd. Price, 3s. each.

"Some Clock Notes," a pamphlet issued by Venner Time Switches, Ltd., whilst it follows mainly the lines of the high-class clocks used by the Company, is a technical essay on clock-work that should interest any engineer. It is well illustrated and lucidly expressed.

Jerusalem Water and Lighting Scheme.—*The Times* correspondent at Haifa says that he understands that a British company is in process of being formed in London to purchase the Jerusalem lighting, traction, and water supply concession held by M. Mavromatis. The Anya River, near Jaffa, which is part of the Rutenberg concession, is contemplated as a source of water supply. A London engineer is expected in Jerusalem in October to begin work on an electric lighting project. It is reported that M. Mavromatis will receive 25 per cent. of the stock of the new company, which, it is also reported, will have a capital of £1,000,000.

Annual Holidays.—The works of Messrs. E. Brook, Ltd., Huddersfield, will be closed from this evening (Friday) until August 16th.

The Electrical Refrigerator Load.—The interest of the central station in electric refrigeration rests on the fact that the current demand represents an almost steady 24-hour, 365-day load, and though the extra power requirements may not be very considerable, it is the ideal toward which power companies have always been working. The load of electric refrigeration is even better than it may appear at first thought. Such variation in load as may develop will tend to make a greater demand on the power lines in summer than in winter, and in this way will take the place of the added lighting and heating load which the systems are required to deliver during the winter. At the moment it looks as if the field might soon become overcrowded with refrigerators, which would tend, through keener competition, to eliminate profits in manufacturing and selling and thus, indirectly, suppress the enthusiasm of manufacturers and dealers. Already there are at least half a dozen quite large companies in the Canadian field, either manufacturing or making preparations to manufacture immediately. It will be best for everybody if these manufacturers can work together to the extent of pooling their publicity to the general public and maintaining fair prices, that they may be able to continue to make a dependable product and supply a proper service. The indispensability of the electric refrigerator has not yet been proven in the mind of the average householder, and if the machines should be cheapened to the extent that they are not reliable, that customers begin to discard them or speak of them in other than the highest terms, it would be a very unfortunate thing for the industry as a whole.—*Electrical News* (Toronto).

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report August 3rd:—Copper (electrolytic) bars, £67 15s., £1 increase; ditto ditto sheets, no change; ditto ditto wire rods, £77 15s., £1 increase; ditto ditto h.c. wire, 9¾d., ¼d. increase.

Messrs. James & Shakespeare report August 3rd:—No change in the prices of copper bars (best selected), sheet and rod, and English pig lead.

Messrs. Edward Till & Co. report August 3rd:—India-rubber, Para fine, 1s. 7¼d., ¼d. increase.

Model Engineering Exhibition.—The eighth of the series of *Model Engineer* exhibitions opens on September 17th at the Royal Horticultural Hall, Westminster, S.W.1, closing on September 25th.

Lighting and Power Notes.

Abergele.—Street Lighting.—The Urban District Council has considered tenders for street lighting from the Abergele Gas Co. and the Electricity Distribution of North Wales and District, Ltd., and has decided to accept the offer of the latter company.

Annfield Plain (Durham).—Year's Working.—The accounts for the past year of the electricity undertaking show total expenditure to date of £39,854. The revenue for the year was £8,486, working expenses £3,919, and loan charges, &c., £4,080, leaving a surplus of £487.

Argentina.—Buenos Aires.—A new steam turbo-generator set of 20,000-25,000-kW capacity has recently been added to the power station at Buenos Aires of the Compagnia Italo-Argentina di Elettricita. The turbine, which was constructed by the Società Franco Tosi, of Legnano, Italy, is of the three-cylinder, high-speed type.

Australia.—Melbourne.—*Year's Working.*—We have received from Mr. W. H. Alabaster, city electrical engineer, a copy of his report, together with the statement of accounts, on the working of the electricity undertaking for the year ended December 31st last. The total revenue amounted to £472,782, as compared with £458,307 in the preceding year. Working expenses decreased by £3,202 to £278,424, with a consequent increase in the gross profit of £17,676 to £194,358. After meeting capital charges there was a net profit of £72,483, as compared with £64,656, of which £25,000 was contributed to the town fund. The capital expenditure during the year, which included £57,582 for mains, amounted to £110,058. The sales of electrical energy amounted to 64,050,044 kWh, a decrease of 1,441,764 kWh. The decrease is due to the further transfer of bulk supplies in accordance with arrangements made by the Council with the Victorian State Electricity Commission. The average revenue per kWh sold increased from 1.679d. to 1.73d. An agreement was entered into with the State Electricity Commission for the supply to the Council's power station of 11,000 kW of electrical power for a period of five years as from November 1st, 1925. The Council also gave its approval to an agreement for the supply to the Commission of electricity required by the Melbourne Harbour Trust within the city area, for a period of five years, representing an additional revenue of approximately £1,500 per annum.

Birkenhead.—Loan.—The Electricity Committee has recommended that application be made for sanction to a loan of £60,000 in connection with a supply of electricity to Wirral.

Birmingham.—Fuel Supply.—At a meeting of the Electric Supply Committee on July 28th it was reported that the fuel position had improved and, apart from the necessity for making use of fuel of poor quality, presented no cause for uneasiness as far as continuity of the supply of electricity was concerned. It was also stated that, in spite of the effect of the stoppage in the coal industry, the sales of electricity during the June quarter were 4¼ per cent. in advance of those for the corresponding period of 1925.

Bradford.—Street Lighting.—At a recent meeting of the City Council it was decided that the street lighting on tramway and railless-car routes should be by electricity.

Cheadle and Gatley.—Price Reductions.—The Urban District Council has decided to reduce the charges for electricity as from October 1st next to 6d. per kWh for lighting, 2½d. per kWh for power, and for heating to 2d. per kWh during the winter months and 1½d. per kWh during the summer months.

Chester.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer: Mr. S. E. Britton) for the year ended March 31st last show a total income of £66,908, as compared with £57,048 in 1924-25. Working expenses amounted to £34,698, as against £30,076, leaving a gross profit of £32,210 (£26,972). After providing for capital charges, there was a net profit of £12,612. The sales of electrical energy increased from 4,883,378 to 5,720,300 kWh.

Clitheroe.—Electricity Supply.—It was intimated at a meeting of the Town Council, on July 28th, that an electricity supply would be available 17 weeks from the finish of the coal dispute. Delay was caused through a strike clause inserted in the contract.

Continental.—Italy.—A pulverised fuel-burning installation has recently been completed by the Società di Combustione Economica e Impianti Elettrici, of Milan, at the works of the Società Elettricità e Gaz, in Rome, where four boilers are now working with pulverised fuel.

Germany.—A new 22,500-kW steam turbo-generator has recently been installed at the Trattendorf electric power station in Berlin. The turbine, which was built by Thyssen & Co., of Mulheim-an-dei-Ruhr, is designed to run at a speed of 3,000 r.p.m.

Sweden.—A h.p. transmission cable for a working pressure of 50 kV has recently been laid in the Sound between Sweden and Denmark for the transmission of power to the latter country from the hydro-electric power station on the Lagan river. The total length of the line is 17¼ miles, of which 3¼ miles is under the sea.

Croydon.—Year's Working.—The report of the borough electrical engineer (Mr. A. C. Cramb) on the working of the electricity undertaking for the year ended March 31st last shows a total revenue of £235,267, as compared with £204,757 in the preceding year. Working expenditure, including special expenditure charged to revenue, amounted to £160,768, as against £138,898, leaving a gross surplus of £74,499 (£65,859). After providing for capital and other charges, there was a net surplus of £9,250, as compared with £9,194 in 1924-25; this was transferred to reserve. The capital expenditure during the year amounted to £118,292, and included £55,409 for machinery and plant and £49,820 for mains, services, and meters. The consumption of electricity increased from 18,724,318 to 22,033,211 kWh, and the maximum supply demanded from 9,200 to 11,300 kW. A new 10,000-kW set was put into commission during the year, and a second set of similar capacity is in course of erection and is expected to be ready for next winter's load.

Douglas (I. of M.).—ELECTRICITY SUPPLY.—At a special meeting of the Corporation of July 26th the proposed extensions to the power station were considered. A report of the Electricity Committee was submitted, in which it was recommended that the Council's resolution approving the installation of oil engines should be rescinded, and that steam plant of 1,000-kW capacity should be installed. It was also recommended that legal advice should be obtained on the Council's agreement with Messrs. Hancock & Dykes. The recommendations were approved by the Corporation.

Ealing.—LOAN.—The Town Council is applying for sanction to a loan of £25,000 for mains and services.

Eastbourne.—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. J. K. Brydges) on the working of the electricity undertaking for the year ended March 31st last shows a total revenue of £84,153, as compared with £80,273 in 1924-25. Working expenses increased from £49,554 to £53,867, resulting in a gross profit of £30,286 (£30,719), to which was added land rent of £33. Capital charges, &c., absorbed £25,306, and there was a net surplus of £5,013, which was carried to appropriation account, together with a balance from the previous year of £38,037, making a total of £43,050 available. Of this amount £4,300 was transferred to relief of the rates and the remainder carried forward. The sales of electrical energy increased from 5,614,602 to 6,842,414 kWh, and the maximum supply demanded from 3,638 to 4,385 kW. The average revenue obtained per kWh fell from 3.29d. to 2.73d.

Guildford.—SPECIAL ORDER.—The Corporation has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity to certain parishes in the urban districts of Guildford and Hambledon.

Halifax.—ELECTRICITY SUPPLY PROGRESS.—In connection with the linking-up scheme between the Halifax and Huddersfield Corporation electricity undertakings, the cables are now all laid and final tests will be made shortly. It is hoped that the installation of switchgear, transformers, &c., will be completed and the scheme working by about the middle of September. The demand for electricity for household uses, in addition to lighting, shows a steady increase, and all new houses in the borough are being supplied with electricity. The work of converting the system of supply from d.c. to a.c. is proceeding in sections. Three h.p. sub-stations are being erected, and two further sub-stations are to be introduced later.

Kettering.—YEAR'S WORKING.—The report on the working of the Urban District Council's electricity undertaking (engineer, Mr. W. A. Walker) for the year ended March 31st last, records a total income of £50,590 and working expenditure of £28,727, leaving a gross profit of £21,862. After providing for capital charges there was a net surplus of £3,960. A contribution of £1,100 was made to the borough fund. The electrical energy sold amounted to 5,327,484 kWh.

Leeds.—LOAN SANCTIONED.—The Electricity Committee has received sanction to a loan of £55,000 for the provision and equipment of a sub-station.

Liverpool.—YEAR'S WORKING.—We have received from Mr. H. Dickinson (city electrical engineer) a copy of the accounts of the electricity undertaking for the year ended March 31st last. The total revenue amounted to £1,096,052, as compared with £1,037,673 in the previous year. Working expenses amounted to £643,012, as against £591,269, leaving a gross profit of £453,040 (£446,404), to which was added a contribution to the sinking fund by the Housing Committee of £2,991, making a total of £456,031 available. This was distributed as follows:—Interest, £168,631; repayment of loans, £533; contribution to Bootle Corporation stock redemption fund, £1,280; sinking fund, £150,293; renewal fund, £70,293; contribution to city rate, £65,000. The amount spent on capital account during the year was £802,264, the chief items being £198,153 for buildings, £314,993 for machinery, and £275,826 for mains.

Maidstone.—PLANT EXTENSIONS.—The Town Council on July 26th gave approval to a scheme for further extensions at the electricity works, at an estimated cost of £60,000, including building extensions, £8,000; one 5,000-kW set and accessories, £25,000; switchgear and cables, £1,500; boiler and accessories, £22,000; cooling tower, motors, &c., £3,000.

Manchester.—PROGRESS DURING JUNE.—During the month of June the Corporation electricity undertaking showed an increase in connections of 1,489 kW, bringing the total to 287,176 kW; and the number of applications received for supply, including consumers for additional supplies, was 825, representing a total of 1,992 kW. The number of hired cookers connected increased by 150, bringing the total actually on circuit to 1,857. Applications for the hire of cookers totalled 115. A new sub-station containing two 500-kVA transformers was put into commission during the month, and a 500-kVA transformer was replaced by one of 750 kVA at McConnel & Co.'s mill.

Newark-on-Trent.—INQUIRY.—On July 20th, Sir William Marwood held an inquiry into the matter of wayleaves and the erection of overhead cables by the Derbyshire and Notts. Electric Power Co. for the purpose of supplying electricity in bulk to Newark. The inquiry arose from objections by certain landowners to poles being erected and overhead wires crossing their property.

Northants.—INQUIRY.—Sir William F. Marwood, on July 23rd, held inquiries at Wolverton and Earls Barton relative to the proposal of the Northampton Electric Light and Power Co., Ltd., to erect overhead cables for the transmission of electricity. It was stated for the company that the cost of an underground system would be three times that of overhead cables. At Wolverton strong opposition was offered by the Urban District Council, and there was also opposition at Earls Barton by the Rural District Council and the Parish Council, who objected to overhead mains in the streets.

Pudsey.—ELECTRICITY EXTENSIONS.—The Town Council has adopted a proposal to borrow £10,000 for electricity extensions. In future the charge for electricity for domestic purposes will be based on rateable value. The net profits on the undertaking last year amounted to £2,272, or 23 per cent. on the capital expenditure. The present liability is only £2,436.

Shipley.—ELECTRICITY IN BULK.—The Urban District Council has decided to purchase electricity in bulk and to reorganise the Electricity Department upon a distribution basis. A special sub-committee has been authorised to continue negotiations with a view to making a definite agreement for obtaining bulk supplies.

Shrewsbury.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £4,750 for buildings and plant.

Southend-on-Sea.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £10,000 on account of an estimated sum of £13,935 required for the purchase and insallation of additional plant at the electricity works.

Stafford.—YEAR'S WORKING.—The accounts of the Corporation's electricity undertaking (engineer, Mr. W. H. Robins) for the year ended March 31st last, show a total revenue of £38,404, and working expenditure of £16,719, leaving a gross profit of £21,686. Capital charges and revenue contributions to capital outlay absorbed £19,113, and there was a net surplus of £2,619, which was carried to appropriation account with a balance of £8,169 from the previous year, making a total of £10,788, of which £4,500 was contributed to the borough fund and the remainder carried forward. The sales of electrical energy increased from 5,737,860 to 5,812,018 kWh.

West Ham.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer, Mr. F. W. Purse) for the year ended March 31st last, shows a total income of £353,686, as compared with £367,873 in the preceding year. Working expenses amounted to £206,962, as against £236,550, leaving a gross profit of £146,724 (£131,323), to which was added revenue from other sources, making a total of £150,663. After deducting capital charges, and special works charged to revenue, there was a net surplus of £37,556, as compared with £38,852 in 1924-25. This was distributed as follows:—Rate relief, £15,940; reserve, £21,616. The amount spent on capital account during the year was £157,986, and included £95,421 for machinery and plant. The electrical energy sold increased from 58,307,188 to 63,520,349 kWh, and the maximum supply demanded from 21,900 to 24,060 kW. The average price obtained per kWh fell from 1.50d. to 1.32d.

Weymouth and Melcombe Regis.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer, Mr. G. Nicolson) for the year ended March 31st last, show a total income of £28,799, as compared with £25,742 in the preceding year. Working expenses were £19,122, as against £18,410, leaving a gross profit of £9,677 (£7,333). After deducting capital charges there was a net profit of £4,222, as compared with £2,942 in 1924-25. The consumption of electrical energy increased from 1,585,099 to 1,880,354 kWh.

Tramway and Railway Notes.

Brazil.—RAILWAY ELECTRIFICATION.—A *Reuter* message states that the electrification of the Central Railway of Brazil will be commenced before the end of the year. The scheme will be financed by the National Government, and the first section to be electrified will be the suburban lines of Rio de Janeiro for a distance of 40 miles.

Continental.—SWEDEN.—In reply to questions put by *Stockholms Tidningen* regarding the plans for the electrification of the State railways, the Railway Board states that no decision has yet been made as to which lines shall be electrified next, but they will probably be the southern trunk line (Stockholm-Malmoe) and the Stockholm-Upsala line, where the traffic is the greatest of all the railways not yet electrified.—*Reuter's Trade Service* (Stockholm).

Manchester.—THROUGH-RUNNING.—According to the *Manchester Guardian*, there is a prospect of a scheme of "through" tramway services being arranged on the Manchester and Salford routes. A schedule of such routes was submitted to the Manchester Tramways Committee at its meeting recently and agreed upon, but the details will not be definitely decided upon until the principle has been approved by the Salford authorities. The Committee has decided, as an experiment, to close the Cedar Street line on the Hightown route, and run the cars along Elizabeth Street by means of a loop line.

Stourbridge.—INQUIRY.—The application of the Dudley, Stourbridge and District Electric Traction Co., Ltd., for authority to abandon the tramway routes from Lye to Stourbridge and from Stourbridge to Wollaston was the subject of an inquiry on July 23rd by Messrs. A. D. Erskine and T. L. Paterson for the Ministry of Transport. For the Company it was stated that it was now at the end of its resources and could only carry on by means of a "pooling" arrangement with the other companies. Until the advent of the 'buses, these tramway routes paid their way. Track renewals were due, and in consequence of losses being sustained there was no money to carry them out. Further, new trams were required. An arrangement had been made with the authorities concerned for the reinstatement of the roads and the provision of adequate 'bus services. Mr. O. C. Power (traffic manager for the Midland Red Co.) intimated that, in the event of the tramways being abandoned, his company would maintain an adequate service of 'buses.

Telegraph and Telephone Notes.

Germany.—TELEPHONE DEVELOPMENT.—A sum of about 100,000,000 marks is to be used by the German post office authorities for the development of the telephone system of the country. Most of this amount is to be devoted to expediting the completion of the work of introducing automatic exchanges and the laying of further long-distance cables.

Greece.—RADIO TELEGRAPHY.—No time has been lost by the Eastern Associated group of telegraph companies in dealing with its Greek concession. The *Financial Times* states that a specification for the erection of a wireless station has been drawn up and is being put out to public tender.

Hungary.—TELEPHONY.—A Department of Overseas Trade report on the commercial and industrial situation of the country points out that little development took place in telegraphy and telephony in 1925, although certain sums had been set aside for laying an underground cable of 100 double lines between Budapest and Vienna. Three automatic telephone exchanges will, it is hoped, be in working order by the end of 1927.

TELEGRAPHY.—The length of telegraph wire operating in Hungary is as follows: Trunk lines, 86,213 kilometres; local lines, 279,067 kilometres; the length of wire operated by the State is given as 55,922 kilometres, whilst that operated by the State Railways is 27,066 kilometres. The number of employés working under the postal, telegraph and telephone administration is stated to be 18,300.

Isle of Man.—TRUNK TELEPHONY.—The Postmaster-General, who has been inquiring into the question of extending the main trunk telephone service to the Isle of Man, has informed the Manx Governor that the investigation has been completed, and that he hopes details of the scheme may be available in the autumn.

Italy.—TELEPHONE DEVELOPMENT.—Plans for the development of the telephone and telegraph systems provide for many new underground telephone lines to be laid, by means of which long-distance conversation will be possible, not only between all parts of the country, including Sicily, but also with Switzerland, the North of France, England, Belgium, Holland, Germany, Czecho-Slovakia, Austria, and Poland; part of the system will also be available for the telegraph service. The first group of lines has been entrusted to the Società Italiana Reti Telefoniche Internazionale, which is already engaged on the subterranean Turin-Milan-Genoa cable; the first section will be from Rome to Naples, which is to be terminated within 30 months; others are to be laid successively, and all are to be completed within five years.

NEW CABLES.—At the same time the Government is interested in a plan for large extensions to Italy's submarine cable system. It is stated that a new cable is to be laid shortly from Anzio, passing between Corsica and Sardinia, to Barcelona, and thence to Malaga, whence it will meet the cables already existing in the Atlantic which branch off, *via* the Canary Islands and Cape Verde, to South America, and, *via* the Azores, to North America. The total length of the Anzio-Barcelona-Malaga cable, for which the Spanish Government has already given the necessary authorisation, will be about 1,100 miles. Later a very long cable will be laid to connect Anzio directly with the Azores, which will greatly facilitate communication between Italy and North America.—*Reuter's Trade Service* (Milan).

Marine Radio Operators.—INDUSTRIAL COURT'S AWARD.—The conditions of service for sea-going wireless operators are the subject of an award issued on July 31st by the Industrial Court, which has decided that when vessels are in port articled operators may, when required, be employed on cargo or clerical duties, but that overhaul, repair, and renewals of wireless apparatus which cannot be accomplished at sea shall be the first call on their time. Performance of cargo or clerical duties will not be required on Class 1 vessels, foreign-going vessels, and other classes when in their ports of final discharge. According to the *Evening News*, the monthly rates of pay for Grade 1 operators on articles on Class 1 vessels of 16,000 tons and over are to be £19, the rates descending to £7 for Grade 3 operators on all classes of vessels. Operators whose service abroad exceeds 12 months are to be entitled to certain additional monthly pay.

The Telephone Service.—NEW SUBMARINE CABLE.—The English end of a submarine telephone cable from La Panne, Belgium, was recently landed at Dumpton Gap, Broadstairs. It is said to be the largest of its kind in the world, and will enable 24 conversations to be carried on simultaneously.

TELEPHONE SUPERVISORS' PAY.—An award was issued on July 30th by the Industrial Court on a claim by telephone supervisors for increased pay. The Court decided against any alteration in the weekly hours of attendance or additional pay for Sunday duty, but awarded the following annual basic scales of pay:—Supervisors, London, £140-£7 10s.-£170; provinces, £130-£5-£160, subject to the current cost-of-living bonus, and all allowances to be continued.

Radio Notes.

Hungary.—TWO STATIONS.—A Department of Overseas Trade report on the commercial situation of the country states that the year 1925 saw a great advance in wireless in Hungary, and early in 1925 the new broadcasting station at Csepel Island was put into operation on a wave-length of 546 metres with a power of 2 kW; programmes were not transmitted regularly until towards the end of the year. There is also working in Budapest a station under the auspices of the Hungarian Telegraph Bureau (*Magyar Tavirat Iroda*), which has no set time for transmission; it works on a wave-length of approximately 900 metres and exists primarily to supply its branches (at which places receivers have been established) in Szeged, Szombathely, Györ, Pecs, and Debreczen, with news and other information.

India.—NEW COMPANY.—The prospectus of the Indian Broadcasting Co. has been issued. The authorised capital is 15 lakhs of rupees (about £112,000 at present) in 10 rupee shares, of which 60,000 are being issued now to the public and 2,500 reserved for wireless apparatus importers who, under the agreement between the company and the Secretary of State, have become members of the company. The company intends in the first instance, says the *Financial Times*, to establish transmission stations in Bengal and Bombay. Under the agreement with the Secretary of State the company will receive for the first five years 80 per cent. of the value of the licences issued and 10 per cent. of the value of all receiving apparatus and accessories imported. There is no limitation of the profit for the first five years. After that period the Government may restrict the maximum dividend payable to 15 per cent.

Spain.—NEW BROADCASTING STATION.—It is reported that a powerful broadcasting station, founded by the Unión Radio Española, will shortly begin to function at Seville.—*Reuter's Trade Service* (Madrid).

The B.B.C.—MEMBERSHIP.—The total membership of the British Broadcasting Co., Ltd., is now 1,715, and its staff (excluding orchestras, &c.) is 725, including 250 engineers.

U.S.A.—WAVE-LENGTH CHAOS.—The United States is trying to avoid the "chaos in the air" which is threatened owing to the loss of broadcasting control by the Department of Commerce, brought about by a ruling by the Attorney-General that the authority Mr. Hoover had assumed as head of the Department of Commerce was without legal basis. He is none the less seeking to intimidate "pirates" by announcing that he will prosecute them for "wilful and malicious" interference with radio rules, says the *Daily Mail*. So far some six New York stations have appropriated wave-lengths other than those allotted them by the Department of Commerce, their managers protesting that they are not "pirates," but merely taking advantage of the existing legal chaos to discover wave-lengths which interfere less with other programmes than those they have hitherto been granted. In Chicago the Broadcast Listeners' Association has issued a call to all listeners to boycott all stations pirating lengths. Meanwhile, business organisations associated with the wireless industry are calling meetings to perfect a "gentleman's agreement" for the benefit of the industry as a whole until such time as Federal legislation can be enacted to restore Governmental control of broadcasting stations.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—August 23rd. Electricity Commission of Victoria. 10-in. disk suspension insulators. (July 2nd.)

September 1st. Victorian Government Railways. Automatic sub-station equipment for Elwood sub-station. (B.X. 2598.)*

August 11th. City Council. H. and l.p. 3-phase sub-station switchgear.*

August 10th. Postmaster-General's Department. Telephone exchange indicators. (B.X. 2597.)*

August 31st. Telegraph equipment. (B.X. 2653.)*

September 14th. Telephonists' telephones and hand sets.

September 21st. Switchboard keys and parts. (B.X. 2669.)*
October 12th. Automatic exchange equipment.
October 5th. Switchboard cords. (B.X. 2747.)*

SYDNEY.—September 20th. Municipal Council. H.p. d.c. apparatus for cable testing.
September 6th. New South Wales Public Works Department. Oil circuit breakers, Barren Jack hydro-electric development.

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Barnes.—August 23rd. Urban District Council. One 3,000-kW turbo-alternator, with condensing plant and auxiliaries. (July 30th.)

Belgium.—August 11th. Post and Telegraph authorities. Supply and installation of telephone cables at Braine l'Alleud, Nivelles, Courcelles, Ciney and Saint Gerard. Particulars (Cahier des Charges Special No. 3-197) for 7 fr. 20 c.

SCHAERBEEK.—August 12th. Municipal Council. Twelve sectionising boxes, and a transformer oil purifying pump. Particulars from the Service d'Electricité, Hotel Communal, Schaerbeek.

Coventry.—September 3rd. Electricity Department. Buildings, foundations, and subways, two 15,000-kW turbo-alternators, condensing plant, and auxiliaries, water-tube boilers, complete with accessories, coal- and ash-handling plant, switchgear, pipework, crane, and cooling towers. (July 23rd.)

Croydon. — September 6th. Electricity Department. Two 50,000-lb. water-tube boilers and equipment. (July 30th.)

Denmark.—AARHUS.—August 17th. Lighting Department. Steam turbo-generator and boiler plant. (A.X. 3371.)*

Doncaster.—August 14th. Town Council. Wiring for electric lighting of 238 houses, Warmsworth Road (South) site. Form of tender from R. E. Ford, Housing Surveyor, 3, Priory Place.

Dundee.—August 20th. Electricity Department. Supply, delivery, and erection of six 200-kVA outdoor-type transformers. (July 30th.)

Egypt.—CAIRO.—October 15th. Ministry of the Interior. Installation of electric power station equipment at Keneh and Luxor. (B.X. 2627.)*
September 15th. Electrical distribution system for Luxor. (B. 2737.)*

Halifax.—August 7th. Electricity Committee. Steel sheet piling at electricity works. Plans, form of tender, &c., from the borough engineer.
August 16th. Electricity Committee. Sub-stations, Powell Street and Stannary Street. Form of tender from Borough Engineer, Crossley Street.

Huddersfield. — August 12th. Town Council. Electricians' work required in erection of 25 houses, Brackenhall Road, Sheepbridge. Form of tender from Borough Architect, 26, Ramsden Street.

India.—August 9th. India Store Department. Electrical generating plant for the Peshawar power station of the North-Western Railway. (B.X. 2644.)*
September 10th. Switchgear and auxiliary plant in connection with the G.I.P. Railway electrification. Forms of tender (2/8.) from the above.

Liverpool.—August 31st. Corporation. Supply and installation of a closed-circuit, code-signalling street fire-alarm and telephone system. (July 30th.)

London.—August 23rd. County of London Electric Supply Co., Ltd. Supply and erection of a central evaporating equipment. (July 23rd.)
METROPOLITAN ASYLUMS BOARD.—August 25th. Rewiring electric lighting circuits and installing main supply cable at Princess Mary's Hospital, Cliftonville, Margate. Installation of laundry apparatus at Woolwich Casual Ward. Covering with non-conducting composition steam pipes, &c., Park Hospital, Hither Green. (See this issue.)

Manchester.—August 21st. Waterworks Committee. Supply and erection of two electrically-driven centrifugal pumps, with switch- and starting gear, &c. (July 30th.)

Newark.—August 12th. Waterworks Department. One 200-kVA oil-cooled static transformer and 11,000-V switchgear cubicle. (July 23rd.)

New Zealand.—CHRISTCHURCH.—October 19th. Christchurch Drainage Board. Three sets of electric centrifugal pumping plant. (A.X. 3215.)*
WELLINGTON.—August 24th. Public Works Department. Synchronous condensers for the Waikaremoana electric power scheme. (B.X. 2608.)*
August 30th. 400-V, 3-phase, slip-ring induction motors and starters.*
September 28th. Three electrically-driven low-lift pumps, with control apparatus, for the Taleri drainage. (A.X. 3274.)*
November 2nd. Electric generators and turbines for Waikaremoana electric power scheme. (B.X. 2622.)*
Indoor control gear and switchgear in connection with the Waikaremoana electric power scheme. (B.X. 2675.)*
110,000-V transformer for Waikaremoana power scheme. (B.X. 2744.)*
September 7th. Synchronous condenser for the Arapuni electric power scheme. (B.X. 2654.)*
August 10th. Postmaster-General's Department. Dry cells. (B.X. 2649.)*

DUNEDIN.—September 8th. City Council. One reaction waterwheel, with governor and valves, &c., one 3,000-kW generator, four 1,000-kW transformers, switchboards, oil-break switches, voltmeters, &c. (B.X. 2676.)*

Roumania.—CONSTANTZA.—September 15th. Port Administration. Supply and erection of 8 electric portable cranes. (A.X. 3399.)*

Sevenoaks.—September 1st. Urban District Council. Supply and installation of an electrically-driven siren at the fire station. (July 30th.)

Sittingbourne.—August 16th. Sittingbourne and Milton Joint Hospital Board. Electric lighting installation for the hospital buildings. Specification and forms of tender from Mr. T. W. Ellis, engineer to the Board, 70, Victoria Street, S.W.1.

Skelmanthorpe.—August 7th. Electric lighting installation at Liberal Club. Tenders to Mr. G. H. Ellis, Strike Lane.

South Africa.—August 12th. South African Railways and Harbours. Electric cables and wires and bare copper wire (for 12 months). (B.X. 2639.)*
Installation of electro-pneumatic power working of points and day colour-light signalling, with a.c. track circuits. (July 23rd.)
August 26th. Material for the distribution system, Capetown suburban electrification. (B.X. 2680.)*
JOHANNESBURG.—Town Council. August 19th. H.p. switchgear. (B.X. 2726.)*
August 21st. Reverse power relays. (B.X. 2725.)*
Street-lighting material. (B.X. 2728.)*
PRETORIA.—August 26th. Municipal Council. Equipment for five transformer sub-stations.*

Stirling.—August 26th. Town Council. Electrical work in houses and shops. Schedules from Mr. A. H. Goudie, burgh engineer.

Stoke-on-Trent.—September 7th. Electricity Department. One 10,000-kW turbo-alternator and condensing plant. One natural-draught cooling tower. Ironclad l.p., 3-phase switchgear. (July 23rd.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Adwick-le-Street.—Urban District Council. Accepted:—
cepted :—
Cables and apparatus for extending the electricity supply to Adwick Old Village, the Council houses and Woodlands (£10,913).—Callender's Cable & Construction Co., Ltd.

Barking Town.—Electricity Committee. Accepted:—
Cable (£1,120).—Enfield Cable Works, Ltd.

Birkenhead.—Sanitary Committee. Accepted:—
Electric lighting installation at Central Depôt (£158).—William Bernard, Ltd.
Electricity Committee. Accepted:—
Cable.—Liverpool Electric Co., Ltd. (£858); Macintosh Cable Co., Ltd (£348); W. T. Henley's Telegraph Works Co., Ltd. (£4,485).

Durham.—County Council. Accepted:—
Installation of electric lighting at the Delves Lane Council school (£147).—Deverenx, Moodie & Co.
Electric lighting installation at Silksworth Council school (£179).—Gray Bros. (Newcastle), Ltd.

Epsom.—Urban District Council. Accepted:—
Two Diesel engines for the power station (£12,533).—English Electric Co., Ltd.

Guildford.—Town Council. Accepted:
Cables (£326).—Standard Telephones & Cables, Ltd.
Disconnecting boxes (£10 10s. 6d. each); pathway frames and covers £1 6s. 3d. each); straight-through joint boxes (11s. 10d. each).—W. T. Henley's Telegraph Works Co., Ltd.

Hastings.—Town Council. Accepted:—
Electric light fittings and lamps, White Rock Pavilion (£2,498).—Griersons, Ltd.
50 transformers, £139 each, and 100, £194 each, plus 10 per cent. for contingencies.—Ferranti, Ltd.
Six transformer kiosks (£285 each).—Yorkshire Switchgear & Engineering Co.
Cables.—W. T. Glover & Co.

Irish Free State.—Cork Harbour Board. Supply and installation of two wireless sets. Owing to the imposition of duties on wireless apparatus since the tender for these sets by Marconi (Ireland), Ltd., was accepted in April last, the Board has decided to allow the company a sum of £163 to cover the duty.

Liverpool.—Mersey Docks and Harbour Board. Accepted :—
Cable.—W. T. Henley's Telegraph Works Co., Ltd.

London.—GENERAL POST OFFICE. Accepted :—
150,000 Robertson carbon-filament telephone switchboard lamps.—General Electric Co., Ltd.
Telephone switchboard lamps.—Edison Swan Electric Co., Ltd.

H.M. OFFICE OF WORKS. Accepted :—
Vacuum, gasfilled and radiator lamps.—Edison Swan Electric Co., Ltd.
Vacuum and gasfilled lamps for one year.—Siemens & English Electric Lamp Co., Ltd.

METROPOLITAN WATER BOARD.—*Amendment.*—In our last issue we gave the value of the tender of Messrs. A. Dean and Co., Ltd., for electric lighting at Newington Paths offices, as £82. This was also the amount of the tender of Messrs. Higgins & Griffiths, Ltd., which was accepted. In point of fact, Messrs. Dean's tender was £82 9s. 6d., and was thus greater than the other. It is our usual practice to give prices to the nearest £, but in this case explanation is necessary.

Manchester.—Electricity Committee. Accepted:—
Louvres.—Clyne Engineering Co., Ltd.
6,600-V sub-station switchgear for 12 months.—Ferguson, Pailin, Ltd.

Salford.—Electricity Committee. Recommended:—
7,000 yd. l.p. cable (£2,296).—N.V. Nederlandsche Kabelfabriek (Holland).
Laying four single-core 33,000-V cables between Agecroft and Frederick Road power stations (£2,500).—British Insulated Cables, Ltd.

Sheffield.—Electricity Committee. Accepted:—
Erection of sub-stations: Firvale (£299); Cobnar Road (£3,478).—Thomas Roper & Sons, Ltd.
Six switch fuse sets and three switch panels (£1,399).—A. Reyrolle & Co., Ltd.

Libraries Committee. Accepted:—
Internal telephone system at the Central Library (£90).—Telephone New System Co.

Shrewsbury.—Electricity Committee. Accepted:—
Auxiliary machinery (£217); oil-separator plant (£139).—Belliss & Morcom, Ltd.

Warwick.—Board of Guardians. Accepted:—
Electric lighting installation at the Institution (£700).—Midland Electric Light & Power Co., Ltd.

Wrexham.—The Governors of the County Schools. Accepted:—
Electric light installation at the schools (£137).—E. O. Walker & Co.

Notes.

The Professional Classes Aid Council.—We have received a copy of the fifth annual report of the above Council for the year ended April 25th last. The total number of applications received for aid during the year was 712, and financial assistance was given to 166 families, an increase of 16 on the figure for the previous year. In addition to the direct assistance, 315 applicants were advised where to apply for help. The income for the year amounted to £8,595, and the expenditure resulted in a balance of £559 to the good.

Electrical Association for Women.—On July 22nd some 60 members of the Birmingham and London branches of the Electrical Association for Women visited the Rugby works of the British Thomson-Houston Co., Ltd., and were received by Mr. H. N. Sporborg, director and chief engineer of the Company, and Mrs. Sporborg. Lunch was served in one of the staff dining rooms. In the short time available the visitors were enabled to see many manufacturing processes, including stages in the production of "Mazda" lamps, electric-welding operations, and the manufacture of electrical machines. Considerable interest was found in the apprentice department, where upwards of 600 apprentices are being trained, and much time was spent in the attractively-arranged showrooms, where examples of this Company's other products were seen. A demonstration of electric cooking on the latest type of the Company's electric cooker was given. At tea short speeches were made by Miss C. Haslett (director of the Association) and other officials of the Association, expressing thanks to the Company.

Electrically-Propelled Ships.—The *Board of Trade Journal* says that Lloyd's Register Book shows that there are 40 vessels, with an aggregate displacement of 120,512 tons, employing electric motors connected to the screw shafts, the motors being supplied with energy from generators which are driven either by steam turbines or oil engines. The Book also records 3,576 steamers, of a total of 18,243,539 tons, fitted for burning fuel oil.

Appointments Vacant.—Assistant lecturer at the Royal Technical College, Glasgow. Electrical and mechanical draughtsmen for the Air Ministry. Electrical inspectors for the Government railway department of Mauritius. (See our advertisement pages to-day.)

Defective Electrical Installations and the Fire Danger.—The Fire Insurance Company which has a monopoly of building insurance in Bavaria has, states *Elektrotechnik und Maschinenbau*, recently issued a report dealing with the subject of defective electrical installations and the fire danger. A distinction is made in the report between cases in which the fires were unquestionably due to the electrical installation and those in which they were merely suspected as being the cause. Of the fires in buildings which occurred in 1923-24, it is reported that 1.42 per cent. were due to faults in the electrical installation, while 4.43 per cent. were suspected cases. An inquiry into the prevalence of fires in electrically-equipped farms showed that 23 per cent. were due to non-protected motors and a similar percentage arose from conductors passing through roofs in which hay and straw were stored. Fires arising from faulty electrical installations are stated to be increasing at the rate of 0.9 per cent. per year and the amount of indemnity paid in respect thereof has increased in the past few years from 1.01 per cent. to 9.8 per cent. The report concludes with the remark that the matter is one that should receive the attention of electrical firms who, on the one hand, should take greater care in installations in farm buildings, and, on the other, issue simple instructions to farmers regarding the precautions which must be taken to prevent fires.

London's Electricity Supply.—According to *The Times*, the London and Home Counties Joint Electricity Authority has made an arrangement with the Chiswick District Council under which a capital generating station on a large scale will be set up on the Duke's Meadows by the River Thames at Chiswick. The site combines a plentiful supply of water and adequate railway and water facilities for transport with a situation near the electrical load. There will be no interference with the riverside amenities of the district. The area acquired by the Authority consists of 45 acres on the south-western side of the Southern Railway as it runs from Chiswick over Barnes Bridge. The new works, which it is hoped to get into commission in the winter of 1928-29, will have a frontage of 900 ft. to the proposed Chertsey arterial road, and is eventually expected to produce 250,000 kilowatts. The estimated cost of erection is £2,000,000.

Electric Vehicle Taxation.—In accordance with general expectations the Finance Bill has passed through the Parliamentary Committee Stage without amendment, but two alterations are foreshadowed when the Bill reaches the report stage. One of these is of direct value to owners of electric vehicles, as it represents a just concession, because there is no doubt that electrics cause very little damage to the roads. During the consideration of the Bill in the committee stage, an amendment was moved that electrically-propelled vehicles exceeding 25 cwt. should be charged at 50 per cent. only of the rates of commercial vehicles; the Government accepted the essence of the amendment and promised that at the report stage an amendment embodying the suggestion would be moved by the Government. The other alteration to be brought forward at the report stage is the reduction of the trailer tax from £10 to £6, which alteration will also be of interest to electric-vehicle users.

Large Electric Ship.—The keel of what, it is claimed, will be the first large electric passenger ship was laid at Newport News, Virginia, on March 20th, at the plant of the Newport News Shipbuilding and Dry Dock Company. The new liner will be 601 feet long, with an 80-ft. beam, and will have a speed of 17 knots. Oil-fired boilers will furnish steam to two 9,000-h.p. turbine generators, which in turn will supply the motors connected to the two propellers. The electrical equipment is now being manufactured at the Schenectady plant of the General Electric Company of America.

Large Hydro-Electric Plant.—What, it is said, is to be second in size to that of the Niagara Falls Power Company is the hydro-electric plant which is being built for the Philadelphia Electric Power Company on the Susquehanna River, within four miles of tide water, in the State of Maryland, U.S.A. A dam 4,800 ft. long is being built across the river to form a reservoir of 8,100 acres. Ultimately the station will contain 11 generators, each rated at 50,000 h.p. The initial installation will include seven of these units, giving the station a capacity of 350,000 h.p., four of which are now being made by the General Electric Company of America. They are rated at 40,000 kVA at 90 per cent. power factor and 13,800 V, at a speed of 81.8 r.p.m. It is expected that the annual output of the station will be 1,360,000 kWh. The power house itself will be 175 ft. wide and 620 ft. long, with an ultimate length of 900 ft. From the bottom of the draft tubes to the top of the high-pressure switching station on the roof it will be 230 ft. high. The energy will be transmitted at 220,000 V over two lines to Philadelphia, and each line will have sufficient capacity to carry the full load if necessary.

Cosmic Rays.—The mysterious cosmic ray is to be further studied, this time in the heights of the Andes mountains. Dr. R. A. Millikan, of the California Institute, and Dr. G. Harvey Cameron, his associate, expect to make a scientific excursion during September to one of the highest lakes in Bolivia. Present indications show the best prospects to be in or near the Quimsacruz mountain range, a few miles south-east of La Paz. Peaks of 15,000 to 22,000 feet altitude and numerous lakes abound there. The experiments with the new high-frequency penetrant radiation require the use of a deep alpine lake, free from radioactive salts, and at a very great altitude. It is possible in Bolivia to drive vehicles to altitudes higher than any lake in the United States, and Dr. Millikan hopes to be able to conduct experiments at some location nearly a mile higher than the scene of last summer's discoveries. Heavy apparatus will have to be transported. By attaining the altitude of three miles or more from sea level, the Pasadena physicists expect to eliminate most of the dimming effect of the atmosphere on the cosmic rays. It will then be possible, by means of a delicate quartz-hair electroscope, to receive and identify the remarkable energy emanations. Only by immersing the apparatus deep in a lake is it possible to obtain a blank control test, which is compared with the reception of radiation in the open.—*Science Service.*

Educational.—University of London, University College.—In the Faculty of Engineering the Archibald P. Head Medal and Prize have been awarded to Mr. A. A. E. Hemmer, who also received departmental honours in electrical engineering, third year course. The latter were also awarded to Mr. R. C. Mildner (second year course). Diplomas in electrical engineering were awarded to Messrs. A. Felton (with distinction), D. N. Haskell, M. W. Ramsay (with distinction), V. R. Vajramushti, H. L. White, and J. P. Yates.

A Large Testing Machine.—The great bridge in course of erection at Sydney Harbour, Australia, the largest single-arch bridge in the world, has called for the production of a testing machine on a similar grand scale. It has a loading capacity of 1,250 tons, and will enable the bridge designers to assure themselves that each member of the structure will be of sufficient strength. The machine, which is the largest "universal" testing machine in existence, has been made to the order of Messrs. Dorman, Long & Co., Ltd., by Messrs. W. & T. Avery, Ltd., and is 120 ft. long overall; a built-up compression member 50 ft. in length, having a cross-section 45 in. square, can be tested to destruction. The straining apparatus consists of a hydraulic cylinder and ram capable of working up to a pressure of two tons per square inch. The ram is protected with a coat of electrically-deposited copper to ensure water tightness when applying sustained loads to the members being tested. The hydraulic power is derived from high- and low-pressure accumulators, which are served by two sets of double-acting pumps driven direct by electric motors through machine-cut helical gear.

Formation of a Joint Electricity Authority.—An effort is being made to form a joint electricity authority to supersede the existing Mid-Lancashire Electricity Advisory Board. A committee has been appointed to consider and report on the new scheme, consisting of Coun. A. E. Heaney (Preston), Ald. T. E. Higham (Accrington), and Ald. C. Higham (Blackburn), with Mr. H. Hoyle (Bacup) as secretary, and certain technical experts as advisers.

Wooden Pipes and Conduit.—For more than a century wood has been used in America for constructing pipes and conduit, its valuable properties, *i.e.*, its length of life when it is kept wet and away from the air, and its power of resistance in general, having been early appreciated. Profiting by the experiments made in America, engineers in Czecho-Slovakia, Germany, Norway, and especially Sweden, are advocating the use of wood in electrical and hydraulic stations. The Swedish engineer, Bure Burneij, has gone very fully into its use for conduit and pressure-pipes, and Switzerland is now studying its advantages. The diameter of such conduit varies from 300 to 5,000 millimetres, and it is capable of standing pressures up to 20 atmospheres. It is made of staves in Z-like sections, which guarantee the pipe being water-tight, and are bound with wire or with iron hoops. These pipes are sometimes constructed in a factory and are made in lengths, or they are put together at, or near, the power-station where they are to be employed. Elbows at curves are made of iron, concrete, or specially prepared wood. The pipes are asphalted and tarred before being laid, and all are tested before use. A real point in their favour is that the thickness of the pipe can be exactly adapted to the requirements of each case, while economy is also a factor in the employment of wooden pipes. The amount of wire or iron binding can be adjusted according to the pressure on the pipe, whereas in metal conduit the thickness of the wall of the conduit (especially in the case of low pressure) is in excess of what the pressure would logically seem to exact. The highest limit of pressure for which wooden pipes can be employed to advantage varies inversely as their diameter. The figures below give an approximate idea of this use:—

Inside diameter, metres.	Pressure, atmospheres	Inside diameter, metres.	Pressure, atmospheres.
5.00 ...	3	2.00 ...	5
4.00 ...	3 5	1.00 ...	8
3.00 ...	4	0.50 ...	12

The pressures permissible depend on local conditions and the laying of the pipes, but the fact that their use on the Continent is increasing indicates that engineers consider wooden conduit both satisfactory and advantageous.

Walthamstow and the General Strike.—It will be recalled that the Privy Council recently decided not to accede to the application of the Walthamstow Urban District Council for a charter of incorporation on account of the Council's action during the general strike in cutting off the supply of electricity to a number of its consumers. The matter was discussed at a meeting of the Council last week, when Councillor McEntee (Labour) said that the Council had received no intimation that it had neglected its duty; there were Government Departments to see that it performed its functions in the proper manner. Dr. Watson, the clerk, said that the Council had secured the names of volunteers, which were sent on to Leyton; it had never been asked to open a recruiting station at the Town Hall, and it had not been told that assistance could be secured for the running of the power station. Councillor Dongray thought that these facts and the town's war services should be brought to the notice of the authorities concerned.

An Electric "Hare."—A new type of sport, greyhound racing, was introduced recently on prepared ground near Belle Vue, Manchester. An electrically-propelled "hare" as a lure for the greyhounds, is attached to a projecting bar and runs along the outside edge of the track. Its speed is controlled by an operator stationed in a tower overlooking the track, and with a maximum speed of between 50 and 60 miles an hour the pace of the hare can be so regulated as to keep it always ahead of the nearest greyhound. Immediately the winning post is passed, the hare is whisked into a hole, which is closed by a trap door. It is proposed, if the Manchester venture proves successful, to open other tracks in different parts of the country.

A French Electrical Arbitration Body. — An inter-syndical chamber of arbitration has just been established in Paris under the presidency of M. Ulrich, engineer of the Corps des Mines, president of the Syndicat des Entrepreneurs de Reseaux et de Centrales Electriques, and of the second group of the Union des Syndicats de l'Electricité. The offices of the chamber are in the premises of the latter Union, 25, Boulevard Malesherbes, Paris. The object of the new organisation is to afford to all persons and companies belonging to the electrical industry a rapid and economical means of settling difficulties arising from the execution of contracts and particularly to allow the working of the compromise law of December 31st, 1925. In order to carry out this work the chamber will create services which will be placed at the disposal of all who desire the settlement of differences, and at the same time will furnish a list of arbitrators capable of being personally appointed in matters of arbitration compromises. It is noted that the chamber only comprises electrical syndicates.

High-Power Diesel Land Installations.—It is interesting to note the number of electricity generating stations on the Continent, especially in the Balkans, that are adopting the Diesel engine for the generation of power. The first of the Balkan States to adopt Diesel plant was Rumania, Bulgaria and Greece following later, and the total power supplied to the Balkan States by one Diesel engine manufacturer amounts to 40,000 b.h.p. For the manufacture of tobacco and matches and for use in the Government salt works, twenty Sulzer Diesel engines have been installed by the Regie des Monopoles de l'Etat Roumain. It is not generally known that the largest Diesel-engined power station in the world is at Shanghai, at the works of the Compagnie Francaise de Tramways et d'Eclairage Electriques, which, when the new 5,000-b.h.p. Sulzer Diesel electric set has been installed, will develop 18,000 b.h.p. This company not only works the tramways, but also supplies the electrical energy required for lighting and power in the French concession, in which there are at present about 300,000 inhabitants. The water supply is also managed by this company.

A Visit to the Osram Works.—The Mayor and Corporation of Hammersmith and many influential ladies and gentlemen of the borough visited the Osram Lamp Works recently. The visitors were received by Mr. C. Wilson, and subsequently conducted through the works; the guides who escorted the party thoroughly explained the various processes and operations incidental to the manufacture of "Osram" lamps and radio valves. The visitors also inspected the various staff welfare arrangements, which are of a most comprehensive nature.

The Electricity (Supply) Bill.—In the House of Commons on August 3rd, the Prime Minister informed Mr. Ramsay MacDonald that when the House reassembled on November 9th, after the formal business had been transacted, it was the intention of the Government to devote the remainder of the week to the report stage and third reading of the Electricity (Supply) Bill.

The Vacuum Switch for Large Powers.—According to *Science Service*, the first notable product of the new high-pressure laboratory of the California Institute of Technology is a vacuum switch devised by Mr. R. W. Sorensen, professor of electrical engineering in the Institute. The use of mercury in evacuated bulbs for interrupting small currents is familiar to us and, like these, Professor Sorensen's switch operates in a small glass bulb from which all air has been exhausted as far as possible. With the aid of Dr. R. A. Millikan's high-vacuum laboratory, Professor Sorensen was able to remove all but one thousand-millionth of the original air content of the tube. "For the tests held at the large Laguna-Bell switching station, the Southern California Edison Company furnished a current of 1,000 amperes at 43,000 volts, while its inspecting engineers stood at a very respectful distance, expecting fireworks. Although the switch opened a gap only one inch across, the whole current of over fifty thousand horse-power stopped instantaneously without a tremor. The oscillograph record of the current flow, which can easily detect a thousandth of a second of after-disturbance, indicates as clear a break in the record as if somebody had sliced the paper with scissors." In view of the enormous cost of switchgear for large powers, the possibilities of simple apparatus such as the mercury switch ought not to be ignored.

Electrical Fires.—In his annual report for the past year, Dr. Waldo, J.P., the Coroner for the City of London and Borough of Southwark, said, *inter alia*: Of the 186 fires reported last year, 33 were of electrical origin. Fire and explosion occurred in 15 of the cases in electrical distribution boxes located on public City footways, the boxes in 13 of the fires belonging to the City of London Electric Lighting Co. and in two cases to the Charing Cross Electric Supply Co. In the remaining 18 electrical fires, 12 occurred on the various floors of buildings, caused by defective electrical circuits, and six were due to the overheating of electrical radiators, irons and coils. In his annual and statutory reports to the Home Secretary and the Corporation of the City of London on fire inquests for some years past, Dr. Waldo has suggested, with a view to fire prevention, the compulsory adoption in the City of London of the Regulations for the electrical equipment of buildings of the Institution of Electrical Engineers.

Fatality.—A seven-year-old boy, Frederick Arnold, of South Kensington, was killed recently by coming into contact with a live rail on the West London Extension Railway. A man who went to his assistance received a severe shock, but was uninjured. At an inquest on July 31st a verdict of "Accidental death" was returned.

Liverpool Electricity Works Extension.—There was a large assembly at the opening ceremony, on July 26th, of the extension (No. 3 power house, described elsewhere in this issue) of the Lister Drive electricity generating station of the Liverpool Corporation. Lady Salvidge set in motion the new 25,000-kW turbo-alternator, and the Lord Mayor of Liverpool (Mr. F. C. Bowring) said that the extension which had been consummated that day was only the beginning of a scheme which would not be complete until another four sets of similar size had been installed. A commendable feature was the fact that the whole of the design and the lay-out of the scheme had been prepared by the Corporation's own staff. The opening ceremony was followed by luncheon at the Midland Adelphi Hotel, and one of the main speeches of the day was that by Lord Weir of Eastwood, P.C., LL.D., who proposed "The City of Liverpool," remarking that one of the matters that were exercising attention was the Electricity (Supply) Bill, 1926; he was told that people liked the report of the Committee of which he had been chairman, but not the Bill itself. That appeared to him to thoroughly justify the Bill, for nearly all recent legislation which had been warmly welcomed had been defective in operation.

The toast was acknowledged by the Lord Mayor of Liverpool and Sir Archibald Salvidge, P.C., K.B.E., who commented that in municipal politics councillors and aldermen had to share a full sense of responsibility, unlike the wise men of Parliament who legislated. He had often longed for the day when those who were responsible for reports and Acts of Parliament would be called upon to administer them.

Alderman Fred Smith, proposing "The Contractors," indulged in reminiscences concerning the electricity undertaking.

Major-General Sir Philip Nash, K.C.M.G., C.B., thanked the Corporation officials for their goodwill and co-operation with the contractors. Liverpool Corporation had made a big contribution to national assets and had taken a step forward in a direction that other municipalities might well follow. Last year, so statistics showed, the world had slowed down a little in the matter of electrical development. Italy's increased consumption was only 10 per cent., America and Germany 11 per cent., France 12 per cent., and Great Britain 7½ per cent. Those figures were a good deal less than those of the four or five preceding years, and it had been suggested that the slow growth was due to too high costs, but he was inclined to the belief that the reason was general trade depression. Surely, when Great Britain's trade competitors were slowing down, the opportunity was provided for this country to get ahead. He was in Chicago just 12 months ago, and was then told that the only commodity selling in America at below the pre-war price was electricity. When he came back to this country he found that, whilst coal was 69 points above the 1913 figures of cost, electricity was only 23 points. He believed that this year the average price would come down to about 15, notwithstanding the burden of taxation and rates. The Electricity (Supply) Bill was not what any one industry would have chosen had it had its own way, but if all interests combined to utilise that instrument for the good of the country he felt sure that a big step forward would be taken towards restoring trade and commerce to the position they had temporarily lost.

Mr. Ernest Henshaw also replied to the toast, and Sir Peter Peacock (Warrington) proposed "The Tramway and Electric Power and Lighting Committee and the Electricity Undertaking."

The toast was acknowledged by Mr. F. C. Wilson, chairman of the Liverpool Electric Power and Lighting Committee.

Mr. Harold Dickinson, M.Inst.C.E., M.I.M.E., M.I.E.E., city electrical engineer, said it was difficult to ascertain how, and to what extent, Liverpool would be affected by the Electricity Bill. Whilst Liverpool's requirements for several years to come had been catered for, the new plant should be of great value in any scheme resulting from proposed legislation. There had been many suggestions of co-ordination, amalgamation, and co-operation. Since the 1919 proposals there had been uncertainty in Liverpool, as elsewhere, and the Corporation delayed its extensions as long as it possibly could, to see what became of the 1919 Act. The new buildings and the new plant they had seen that day had been conceived and executed in their entirety within 21 months.

"The Guests" was proposed by Alderman Gordon, and responded to by Prof. E. W. Marchant, D.Sc., M.I.E.E.

Presentations made to Lady Salvidge took the form of a piece of plate from the Liverpool Tramway and Electric Power and Lighting Committee, and a case of silver and tortoiseshell toilet requisites from the contractors.

An Institution in Liquidation.—Notice was given in the *London Gazette* of July 27th, in connection with the Institution of Heating and Ventilating Engineers that a general meeting of the above-named company will be held at 38, Victoria Street, London, on September 14th, at noon, for the purpose of having laid before it an account of the manner in which the winding-up has been conducted and the property of the company disposed of, and of hearing any explanations which may be given by the Liquidator.

Institution Notes.

Institution of Electrical Engineers.—The Council has awarded Students' Premiums of the value of £10 each for the session 1925-26 as follows:—W. F. C. Cooper, "Some Experimental Work on Relays." F. J. Lane, "A Rotary-Converter Automatic Sub-Station." C. T. Melling, M.Sc., "The Design of Current Transformers." H. Pryce-Jones, "Electric Winding Engines in Collieries." E. Youel, B.Eng., "The Thermionic Vacuum Tube."

The Institution of Fuel Technology.—A meeting of the above Institution was held at the Institution of Civil Engineers on July 30th to approve of the Articles of Association and the nominations of officers and Council made by the Organising Committee pursuant to the resolution passed at the first meeting of the Institution held on March 5th (ELECTRICAL REVIEW, March 12th, 1926, p. 414). The chair was taken by Sir William B. Peat, C.V.O., in the absence of the President. Sir William said that up to the time of the meeting 150 members had voted approval of the proposed constitution; a few suggested amendments had been received, but the only one of a critical nature was from Mr. F. Purse. There had been a conference between representatives of the Institution of Fuel Technology and the Institution of Fuel Economy Engineers on the subject of amalgamation between the two bodies, but while the relations between the two bodies had been most friendly, there was disagreement on the question of what should be the qualifications for membership. The Fuel Economy Engineers considered that technical or professional qualifications were necessary, and the other Institution wished to embrace all interested in the subject of fuel economy. He was confident of the closest co-operation between the two Institutions and the door was to be left open to explore the possibilities of establishing one national body. Sir Richard Redmayne, in proposing the acceptance of the nominations, referred to the importance of the article which provided that the other great institutions in the country should be invited to be represented on the Council. No opposition had been received from the other Institutions, and there would be no overlapping between the new and the older bodies. The time and place for the autumn meeting, for which some important papers had already been received, were left to the discretion of the Council.

Institute of Transport.—The *London Gazette* announces that a petition of the Institute of Transport, praying for the grant of a Charter of Incorporation, has been presented to His Majesty in Council, and has been referred to a committee. Petitions for or against such grant should be delivered at the Privy Council Office on or before August 28th.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Blackpool General Purposes Committee decided, on July 29th, by 31 votes to 5, that the Electricity and Tramways Departments should still be carried on under one head, and a resolution was passed expressing the full confidence of the Council in Mr. CHAS. FURNESS as tramway manager and electrical engineer.

Mr. H. C. TRENAM, the general sales manager of Standard Telephones and Cables, Ltd., has been appointed a director of that company. Commander R. L. NICHOLSON, D.S.O., late director of wireless telegraphs in the Posts and Telegraphs Department of the Government of India, has also been appointed a director of Standard Telephones and Cables, Ltd.

The Inverness Town Council has accepted the resignation of Mr. DUNCAN MACLENNAN, the manager of the electricity works, and has appointed Mr. GRANT, who was "runner-up" for the appointment made recently, interim manager for three months.

The Epsom Urban Council is increasing the salary of the electrical engineer from £450 per annum to £600, by two increments, one of £100 on August 13th next, and the other of £50 on August 13th, 1927.

Mr. THORNYCROFT DONALDSON, a director of the company, who has been for a number of years in charge of the engineering side of Messrs. Thornycroft's Southampton works, has now been appointed general manager.

Mr. ALFRED J. T. TAYLOR, of Toronto, president of the Combustion Engineering Corporation, Ltd., has been offered, and has accepted, the position of managing director of the Underfeed Stoker Co., Ltd., of London. He will retain his connection with the former company and with the Ruths Accumulator Co., Inc., of New York, and will spend part of each year across the Atlantic. Two other Canadians will also be associated with Mr. Taylor in his new position, namely, Mr. JOHN ANDERSON, who becomes his chief assistant, and Mr. W. E. MACLEAN, mechanical engineer of the Combustion Engineering Corporation (formerly construction engineer to the State Hydro-Electric Department of Tasmania), who will be on the engineering staff. Mr. Taylor, who is succeeding Mr. W. R. Wood, founder and managing director of the Underfeed Co., will have his headquarters at Africa House, Kingsway.

The marriage took place on July 24th, at Winchmore Hill Congregational Church, London, N., of Mr. ERNEST FREDERICK MICHAEL, A.M.I.E.E., and Miss DOROTHY LOUISE DRAKE, L.R.A.M., only daughter of the late Capt. Drake, of Braunton, Devon.

Mr. F. H. DE LATTRE, accountant of the Birmingham Electric Supply Department, has just retired, after completing 34 years' service with the Department. At a complimentary dinner on July 29th, he was presented by the staff with a silver tea service, together with a lady's vanity bag for Mrs. De Lattre.

The Gillingham Town Council has agreed that the electrical engineer shall have his maximum salary of £600 as from such date as it would normally be increased to £575 per annum, and that the salary be again reviewed at the expiration of a year.

Mr. BRIAN L. WELLS, B.Sc., late assistant electrical engineer to the Rio Tinto Co., Ltd., and previously with the British Thomson-Houston Co., Ltd., has been appointed station superintendent to the Heston and Isleworth Electricity Department.

Mr. G. DACRES, M.I.Mech.E., has resigned his position on the sales staff of Messrs. Hick, Hargreaves & Co., Ltd., to accept an appointment with Messrs. John Musgrave & Son, Ltd., Bolton.

Obituary.—MR. W. SMITH.—The death has occurred of Mr. Wm. Smith, an ex-controller of the telegraph department of Edinburgh General Post Office. He entered the Post Office service in 1870, and in 1911 he was appointed controller of the telegraph department retiring in 1915 after 45 years' service.

HERR C. VON DER HERBERG.—The death recently occurred at Mulheim, Cologne, at the age of 64 years, of Herr Carl von der Herberg, a German authority on electric cable manufacture. The deceased had been associated with the Felten and Guilleaume Carlswerk Geselischaft of that town since 1889, and was a director of the concern.

New Companies Registered.

The Perak River Hydro-Electric Power Co., Ltd. (215,366).—Public company. Registered July 24th, with a nominal capital of £1,000,000 in £1 shares (500,000 preference and 500,000 ordinary). The preference shares are entitled to a fixed preferential dividend at 8 per cent. per annum (non-cumulative to January 1st, 1930, and thereafter cumulative), and rank first for return of capital and arrears of dividend in a winding up. The directors shall, after setting aside such sum as they think fit for reserve fund, and before recommending any dividend on the ordinary shares, further set aside out of the profits of each year which would otherwise be available for dividend on the ordinary shares the amount of such profits or the sum of £15,000, whichever shall be the lesser sum, for the purpose of creating a special "Preference Share Capital Reserve Fund," until the sums set aside and reserved interest thereon amount to £500,000. The objects are:—To enter into the following agreements, viz. (1) an agreement in the terms of Appendix "A" to a preliminary agreement dated December 12th, 1925, between H.H. the Sultan of Perak (acting with the advice and consent of the British Resident of Perak, and with the approval of the Chief Secretary to the F.M.S. Government), and the Rt. Hon. Sir C. A. Montague Barlow, Bt., P.C. (acting as attorney on behalf of Sir W. G. Armstrong-Whitworth and Co., Ltd., of Elswick, Newcastle-on-Tyne), (2) an agreement between the Malay & Eastern Power Development Co., Ltd., of the first part, the Hon. Gideon Murray, Master of Elibank, the Rt. Hon. Sir Montague Barlow, Bt., P.C., Col. B. C. Lockhart-Jervis, L. J. Abrahams, and H. S. Waite, of the second part, and this company of the third part, and (3) an agreement with the Hon. Everard Fielding; to generate, store, use, regulate, transform, transmit, measure and distribute electrical power, to supply the same to governments, towns, corporations, collieries, works, mines, railways, tramways, and others, &c. The subscribers to the Memorandum of Association are all clerks. Minimum cash subscription: 7 shares. The first directors are to be appointed by the subscribers. In the event of the Treasury guaranteeing, pursuant to the Trade Facilities Acts, a loan of £1,250,000, the Treasury may be granted the right to nominate a director, who shall not require any share qualification, and whose remuneration shall be agreed between the company and the Treasury. If and so long as the F.M.S. Government holds, by itself, or nominees, at least £250,000 preference shares, the said Government may nominate a director, who shall not require any share qualification and whose remuneration shall be agreed between the said Government and the company. Directors' qualification (except as above), £250. Remuneration (except as above and except as managing director), £1,000 per annum for the chairman, £800 per annum for the vice-chairman, and £600 per annum each for the others, all free of income tax. By way of further remuneration, the directors shall be entitled in respect of each year when a dividend of not less than 6 per cent. is paid on the ordinary shares, to 5 per cent. of the net profits of such year (such further remuneration not to exceed £5,000, divided between them, in any one year, except with the sanction of a general meeting). The directors may borrow money and issue debentures and other securities, provided that the amount outstanding at any one time (excluding the two loans referred to below) shall not exceed £400,000 without the consent of the company in general meeting. The directors are expressly empowered to borrow or raise and secure in any manner approved by the Treasury a loan not exceeding £1,250,000, or such other sum as the Treasury may agree to guarantee under the Trade Facilities Act, and also to borrow or raise and secure by any securities ranking subject to the securities for the last mentioned loan a sum not exceeding £1,350,000. The company must at all times be and remain a British company, registered in Great Britain and having its principal place of business in the State of Perak. The chairman and vice-chairman and managing director (if any) must be British subjects. Neither the company nor the powers and privileges conferred by the agreement first above referred to, may at any time be or become directly or indirectly controlled or managed by a foreigner or foreigners, or by a person or persons ordinarily resident in a place not within H.M. Dominions or the F.M.S. Solicitors: Mayo, Elder & Co., 10, Drapers Gardens, E.C.2.

Maley & Taunton, Ltd. (215,323).—Private company. Registered July 28th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in brakes, tramway carriages, trucks, motors, accumulators, dynamos, and other equipment for tramways, electrical and mechanical engineers, &c. The permanent directors are:—A. W. Maley, 3, Grosvenor Road, Handsworth, Birmingham, engineer (managing director); H. M. Taunton, 11, Wilton Road, Handsworth, Birmingham, designer. Qualification, 100 shares. Solicitors: Eversheds & Tomkinson, 25, Temple Row, Birmingham.

L. Nicholson & Co., Ltd. (215,280).—Private company. Registered July 26th. Capital, £6,000 in £1 shares. Objects: To adopt agreements (1) with L. Nicholson, and (2) with V. Nicholson; and to carry on the businesses (a) of electrical engineers and dealers in electrical accessories as formerly carried on by L. Nicholson at 9, High Street, Milford-on-Sea; and (b) as coal merchants as formerly carried on by V. Nicholson at the same address. The life directors are:—L. Nicholson, 9, High Street, Milford-on-Sea, electrical engineer (governing director and chairman); V. F. Nicholson, 9, High Street, Milford-on-Sea, coal merchant. Qualification, £100. Remuneration as fixed by the company. Solicitors: Timbrell & Deighton, 90, Cannon Street, E.C.4.

Illusion Signs, Ltd. (215,278).—Private company. Registered July 26th. Capital, £3,500 in 3,000 10 per cent. preference shares of £1 each and 10,000 ordinary shares of 1s. each. Objects:—To acquire from P. E. Hedges, at 2a, Southfield Road, Oxford, his interest and benefit in two British Provisional Patents, No. 18,962/25 and 31,627/25, respectively relating to improvements in optical illusions for advertisement and other purposes and improvements in advertising devices; and to carry on the business of manufacturers of and dealers in electrical and mechanical signs, advertising devices, electrical and mechanical motors and accessories, gramophones, musical instruments, wireless and radio-active appliances, sewing machines, motor-cars and accessories, &c. The directors are:—P. E. Hedges (permanent), 2a, Southfield Road, Oxford; T. Brown, 5a, Glenelon Road, Streatham, S.W.16; A. S. Brooke, 159, Banbury Road, Oxford. Qualification: £100 shares. Solicitor: W. H. Lane, 115a, Chancery Lane, W.C. Registered office: 34, Bedford Row, W.C.1.

Midland Electric Detonator Fuse Co., Ltd. (215,305).—Private company. Registered July 27th. Capital, £2,500 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of permitted explosives for coal mines, &c., electric detonator and other fuses, electric shot firing cables, &c. The directors are:—J. H. Bonser, Cross Lane, Huthwaite, dealer in explosives; W. Bonser, Cross Lane, Huthwaite, dealer in explosives. Secretary: J. H. Bonser. Solicitors: Fidler & Pepper, Sutton-in-Ashfield. Registered office: Portland Square, Sutton-in-Ashfield, Notts.

Longwin, Ltd. (215,304).—Private company. Registered July 27th. Capital, £1,000 in £1 shares (500 10 per cent. cumulative preference and 500 ordinary). Objects: To acquire the business of an electric lamp merchant carried on by F. Long at 64, Stafford Street, Birmingham. The permanent directors are:—F. Long, 317, Charles Road, Small Heath, Birmingham; J. W. Mackrell, Asberne, near Warwick. Qualification, £1. Remuneration, £156 per annum. Secretary: S. S. Sara. Solicitor: E. F. Freeland, 71, Temple Row, Birmingham. Registered office: Prudential Buildings, Corporation Street, Birmingham.

Tel-a-Lite and Accessories, Ltd. (215,333).—Private company. Registered July 28th. Capital, £500 in £1 shares. Objects: To acquire from H. C. Proctor the benefit of certain existing inventions relating to electric lighting systems and apparatus, &c., and to carry on the business of manufacturers and repairers of and dealers in motor cars, &c. The directors are:—A. Norris, 5, Egerton Road South, Heaton Chapel, Stockport; H. Gordon, sen., Bazaar Street, Pendleton; H. C. Proctor, 8, Cedar Street, Southport. Remuneration as fixed by the company. Solicitor: H. S. Heap, 120A, Stamford Street, Ashton-under-Lyne.

E. Cowles, Ltd. (215,350).—Private company. Registered July 29th. Capital, £15,000 in £1 shares (6,000 10 per cent. preference and 9,000 ordinary). Objects: To carry on the business of general, mechanical, and electrical engineers, machine, tool and pattern makers, manufacturers of collapsible tubes, manufacturers of and dealers in goods in metal, wood, gelatine, glass, paper, casein, cotton and silk fabrics, &c. The subscribers (each with one ordinary share) are:—W. H. Day, 112, St. Stephen's Road, Hounslow, manufacturer; W. E. Viney, 68, Coleman Street, E.C.2, C.A. W. H. Day is permanent managing director with £800 per annum as remuneration. Qualification of ordinary directors, 100 shares. Solicitors: Charles Robinson & Son, 233, High Street, Hounslow.

Official Returns of Electrical Companies.

Chelsea Electricity Supply Co., Ltd. (20,468).—Capital, £400,000 in 370,000 ordinary and 30,000 preference shares of £1 each. Return dated April 7th, 1926. 247,180 ordinary and 30,000 preference shares taken up. £218,850 paid. £58,330 considered as paid. Mortgages and charges, £94,675.

Salisbury Electric Light and Supply Co., Ltd. (41,414).—Capital, £75,000 in £1 shares. Return dated March 30th, 1926. All shares taken up. £72,500 paid. £2,500 considered as paid. Mortgages and charges, £16,300.

National Electric Construction Co., Ltd. (53,364).—Capital, £125,000 in 10s. shares. Return dated May 13th, 1926. 170,000 shares taken up. £75,574 10s. paid. £9,425 10s. considered as paid. Mortgages and charges, £75,000.

Urban Electric Supply Co., Ltd. (57,986).—Capital, £640,000 in 240,000 ordinary, 350,000 preference, and 50,000 unclassified shares of £1 each. Return dated May 13th, 1926. 240,000 ordinary and 350,000 preference shares taken up. £490,000 paid on 240,000 ordinary and 250,000 preference shares. £100,000 considered as paid on 100,000 preference shares. Mortgages and charges, £632,832 (£350,000 5½ per cent. debenture stock and £282,832 4½ per cent. debenture stock).

Colombo Electric Tramways and Lighting Co., Ltd. (72,864).—Capital, £150,000 in £10 shares. Return dated June 15th, 1926. 13,084 shares taken up. £840 paid. £130,000 considered as paid. Mortgages and charges, £120,000 5 per cent. debenture stock.

London Platine-Brazilian Telegraph Co., Ltd. (12,093).—Capital, £400,000 in £10 shares. Return dated May 27th, 1926. 37,480 shares taken up. £374,800 considered as paid. Mortgages and charges, nil.

Cuba Submarine Telegraph Co., Ltd. (4,710C).—Capital, £220,000 in 16,000 ordinary and 6,000 preference shares of £10 each. Return dated June 11th, 1926. All shares taken up. £220,000 paid. Mortgages and charges, nil.

W. J. Furse & Co., Ltd. (121,420).—Capital, £35,000 in 9,000 cumulative preference and 26,000 ordinary shares of £1 each. Return dated April 28th, 1926. 9,000 preference and 21,029 ordinary shares taken up. £10,735 paid on 10,735 ordinary shares. £19,294 considered as paid on 9,000 preference and 10,294 ordinary shares. Mortgages and charges, nil.

W. G. Field & Co., Ltd.—A. C. Feasey, 108a, Cannon Street, E.C.4, ceased to act as receiver or manager on July 16th, 1926.

M. E. Robinson & Co., Ltd. — E. E. Groome, I.A., 4, Norfolk Street, Manchester, ceased to act as receiver and manager on June 28th, 1926.

Summers Electric and Engineering Co., Ltd.—H. W. Batty, I.A., of 146, Bishopsgate, E.C., ceased to act as receiver on July 21st, 1926.

Young, Osmond & Young, Ltd. — Mortgage dated July 16th, 1926, to secure £1,500, charged on 28, Broadway, Bexley Heath. Holders: R. Young, Imbrecourt, Canford Cliffs, Bournemouth, and others.

Goswell Engineering Co., Ltd.—Particulars filed of £2,750 debentures authorised July 14th, 1926, charged on the company's undertaking and property, the whole amount being now issued.

G.W.M. Electrical Co., Ltd.—A. C. J. Jackson, of 8, Gresham Road, S.W.9, ceased to act as receiver or manager on July 16th, 1926.

Lumos Radio Valve Co., Ltd.—Debenture dated July 14th, 1926, to secure £100, charged on the company's property, including uncalled capital. Holder: W. Jones, Maitland Park Villas, Hampstead, N.W.

Hammersley Bros., Ltd. — Issue on July 13th, 1926, of £100 debentures, part of a series already registered.

Auto Bulbs, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated July 19th, 1926, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

H. L. Wood & Son, Ltd.—T. Delaney, of 88, Fleet Street, E.C.4, ceased to act as receiver on July 10th, 1926, and W. E. Beale, of 1, Worcester Street, Belgravia, S.W., was appointed receiver in his place under powers contained in first mortgage debentures dated November 17th, 1925.

Paragon Electric Welding Co., Ltd.—A. J. Francis, of Bute Docks, Cardiff, was appointed receiver and manager on July 17th, 1926, under powers contained in debenture dated December 7th, 1925.

Farad Electrical Co., Ltd.—V. S. Wright, of 40-42, King William Street, E.C.4, was appointed receiver and manager on July 14th, 1926, under powers contained in debentures dated June 14th, 1920.

Baxter & Caunter, Ltd.—Two land registry charges on (*a*) 219, Tottenham Court Road, and (*b*) 8, Alfred Place, W., both dated July 8th, 1926, to secure £3,666 13s. 4d. and £1,333 6s. 8d. respectively, in favour of G. W. Kettlewell, Rusham House, Egham. Also two land registry charges of the same date, to secure £3,000 and £2,000 respectively, charged on the above properties, in favour of M. Verden, "Pinnercote," Pinner. (A letter on the Somerset House file states that by a deed of surrender and release dated July 8th, 1925, the above properties were released from a mortgage and debenture dated June 23rd, 1924, by which they were charged, but that, notwithstanding such release, the said mortgage and debenture remain in all other respects in full force and effect.)

Electric Motors (South Wales), Ltd.—Mortgage and further charge dated June 29th, 1926 (supplemental to mortgage dated September 1st, 1921), to secure £15,000 inclusive of £13,000 already registered. Property charged: Property mortgaged by the deed of September, 1921, and certain other property in Penarth Road, Cardiff (the last named property is also subject to the original deed). Holders: Branksome Chine Steamship Co., Ltd., Dowlais Chambers, Cardiff; and C. W. Jones, Boston Buildings, James Street, Cardiff.

R.M.P., Ltd.—Mortgage debenture dated July 8th, 1926, to secure £300, charged on the company's undertaking and property, present and future. Holder: G. P. Power, Adderley Road, Saltley, Birmingham.

Birkdale District Electric Supply Co., Ltd. (70,259).—Capital, £50,000 in £5 shares. Return dated June 16th, 1926. 9,200 shares taken up. £46,000 paid. Mortgages and charges, £9,000 issued to bankers as collateral security. Particulars filed of £25,000 debentures authorised July 14th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000. Also issue on July 20th, 1926, of £21,000 debentures, part of a series already registered.

General Accessories Co., Ltd. (104,464).—Capital, £3,000 in 1,580 6 per cent. preference, 920 5 per cent. preference, and 500 ordinary shares of £1 each. Return dated October 14th, 1925 (filed July 16th, 1926). All shares taken up. £1,580 paid. £1,420 considered as paid. Mortgages and charges, £3,000.

China and Japan Telephone and Electric Co., Ltd. (17,831).—Capital, £75,000 in £1 shares. Return dated June 24th, 1926. 39,761 shares taken up. £25,000 paid. £14,761 considered as paid. Mortgages and charges, nil.

Atlas Wireless Co., Ltd.—G. Dickinson, of 82, Victoria Street, Westminster, S.W.1, was appointed receiver and manager on July 14th, 1926, under powers contained in charge dated September 15th, 1924.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Victoria Falls and Transvaal Power Co., Ltd.

The annual meeting was held on July 29th, the Marquess of Winchester presiding. In moving the adoption of the report (ELEC. REV., July 23rd, p. 151), the chairman, after referring in detail to the balance sheet, said that the net profit for the year had amounted to £363,940, the highest figure they had hitherto reached. That enabled them to pay the full 10 per cent. on the £2,000,000 preference shares and to raise the dividend on the ordinary shares from 12½ to 14 per cent. In looking at the question of finance they must always remember that the company was practically supplying power for the mines on the Witwatersrand, and, of course, consumers entirely disappeared when a mine was worked out. It was true that new mines opened and others increased their rate of production, and hitherto it had been the case that their load had continually increased, and from the notifications received it would still further increase, though it was extremely difficult to say for how long a period the demands for power by the mining industry would continue to grow. There were satisfactory notifications of further power supplies being required from them, and in addition further requirements would, they thought, materialise in the future. The company was under statutory obligation to give supply when demanded, and therefore it must always be prepared to meet all demands. At the present time they were entering upon a somewhat exceptional change in the method of obtaining some of the power which they sold. They would take power at cost from Witbank in terms of an agreement entered into with the Electricity Supply Commission of South Africa, but it would take some time before the terms of the agreement were in full operation. It was the intention that the new Witbank station which they had partially completed would belong to the Electricity Supply Commission. Keeping those points in mind, the financial policy of the company and its requirements in money, present and future, had been carefully considered. The provision for renewals and additions to plant was from time to time largely expended in the business, where it earned a good return, such expenditure being called for by the nature of the business. As an example of expenditure of this nature, he mentioned the 132,000-V transmission line from Witbank to the Rand which would bring the power to their area. That line would remain the property of the company, and when completely paid for would have cost about £350,000. The reserve fund at £400,000, which was represented by liquid resources, now amounted to about 13 per cent. of the share capital, and in view of the magnitude and character of the business, it was intended to gradually increase that reserve in the future. They had allocated a sum of £10,000 to start a staff fund, which it was their intention to augment as profits permitted. The first machine of the Witbank station, together with the transmission line, was connected to their system on May 3rd, and the second machine in the middle of August, while the third machine should be ready early in the autumn. The station restored to the system the necessary provision for spare plant, and for such notifications of new supply as had been received, and provided accommodation for a further expansion of business. The new station would be kept fully loaded and the spare machines kept in the Rand stations, which had been running without proper reserve plant owing to the increased demands of the mining industry. Their contract with the Electricity Supply Commission provided for close co-operation between themselves and the Commission, and was working most satisfactorily and harmoniously, and promised to be a thoroughly satisfactory arrangement.—Mr. A. E. Hadley, in seconding the motion, said that since the last meeting he had spent some time in Johannesburg, and had made a careful inspection of the power stations and other properties of the company, and throughout the system, he was able to assure them, the plant was in thoroughly good condition and most satisfactorily maintained and operated during the year. The maximum load developed by the turbines was 260,000 h.p. Of the energy sold, 16.6 per cent. was in the form of compressed air and the balance in electrical energy. Having referred to an accident of an exceptional character which had occurred in one of the company's four generating stations at Vereeniging shortly before its arrival, where the shaft of a turbo-alternator broke through an inherent defect in the original forging, Mr. Hadley said that the work at the Witbank station was started in October, 1924, and within 18 months the first machine was put into service, which was probably a record in the time of construction. The voltage of transmission between Witbank and their system was 132,000 V, the highest pressure yet employed in Africa, and it gave every promise of being a complete success. The report was adopted.

Aluminium Corporation, Ltd.

The annual ordinary general meeting was held on July 29th, Mr. Kenneth M. Clark in the chair. In proposing the adoption of the report (*vide* our last issue, p. 190), the chairman said that their last meeting was held just after the terrible disaster at their Dolgarrog Works, the bursting of the Eigiau Dam. The past year had been a very stressful one for all concerned. He could not speak too highly of the way in which the staff tackled the difficult problems of keeping the customers for energy supplied, and of clearing the works and village of the great mass of debris that had been deposited by the water, and of making good the damage caused. He visited the works some months ago and was very gratified with the progress made. A large quantity of the electricity used for lighting the various towns on the coast and for working the slate and granite quarries of the district was supplied by their plant, and though the power houses were filled with debris and the pipe lines and tail race buried, there was no cessation of supplies, no town left in darkness, and no quarry rendered idle. The aluminium works was put out of action by a deposit of about 50,000 tons of debris, but every one of their employés gave of his best without stint until the whole was removed and everything cleared up and brought back to original production capacity, and, though they had not yet been able to complete the reconstruction of the low level dam or decide what they would do with the Eigiau Dam, he was glad to report that their works, with those exceptions, were now completely restored and that they had been producing metal for several months past; of course, their output must necessarily be less for some time yet. Having referred in detail to the accounts, he said that with regard to the future he counted their past troubles as a throw-back; their works were in operation again, their valuable connection amongst users of the metal all over the world had been maintained, and in the worst of their trouble they experienced great sympathy and forebearance from many of their customers, and their turnover had been maintained by their purchasing metal in the open market. They had continued work upon the new tunnel between Eigiau and Cowlyd, and hoped to complete it early in 1927. The erection of 100 semi-detached cottages, each with its own garden, had been completed, and the development work in their watershed carried on. The quantity of energy sold to the North Wales Power Company showed a steady increase of about 35 per cent., and was still growing, and had their output of metal not been so greatly curtailed by the disaster, he believed that they would have had a satisfactory report to place before the shareholders. The results might have been a great deal worse, and though they had not yet ascertained the total of their loss, they believed that it was not beyond their strength and that they were once again on the road to a satisfactory result to all their efforts. Their great difficulty had been the shortage of metal, and no greater proof

could have been obtained as to the demand for aluminium than the difficulty which they had experienced in buying supplies to keep their rolling mill going and thus maintain their valuable connection. They had been forced to pay prices that would admit of no profit, and were faced with an exceedingly difficult problem. In this connection, and in view of the fact that the demands of the Power Company for energy were increasing daily, they decided to consider the possibility of securing a source from which they could draw their metal supplies, and, after somewhat lengthy and delicate negotiations, they had been able to secure a lease from the Norwegian Government for over 50 years, at a very satisfactory rental, of a completed water power in Norway, where they would be able, under a subsidiary company, to manufacture the aluminium they needed at a satisfactory cost. That arrangement would also secure that their electrode and alumina works would be in continuous operation and would, they believed, place the company in a stronger and more satisfactory position that it had ever held in the past. Mr. S. G. Bibby seconded the motion, which was carried unanimously.

Scarborough Electric Supply Co., Ltd.

The annual meeting was held on July 24th under the chairmanship of Mr. A. A. Campbell Swinton, who, in presenting the report (*vide* ELEC. REV., July 23rd, p. 151), stated that with the balance remaining in the accounts and the proceeds of the sale of the undertaking to the Scarborough Corporation (£173,484), there was a sum available sufficient to make a return to the shareholders of not less than 25s. in the £, after meeting all expenses, including the proposed compensation to the directors and officers of the company. The purchase price of the undertaking was agreed between two arbitrators—Mr. A. R. Hoare, appointed by the company, and Mr. Spencer Hawes, appointed by the Corporation; Mr. J. S. Highfield was selected as umpire to decide points upon which the arbitrators could not agree. The arbitration, he said, was the first under the Electricity Act of 1888, and would form a precedent for future cases. The settlement had been arrived at in an amicable manner, and he (the chairman) was very pleased at the result. The basis of the valuation was the up-to-date price of plant, less depreciation. The Corporation was also satisfied with the transaction and looked forward to great developments; it found that the plant was in excellent condition. They had had legal advice that the debentures could be paid off at par, but certain of the debenture holders claimed the 5 per cent. premium which they would have obtained if their holdings had matured. A judicial decision was being sought in the matter, and until it was settled the amount available for shareholders was not certain—it might make a difference of 6d. in the £. The report and accounts were adopted, and resolutions were passed for the winding up of the company.

Underground Electric Railways Co. of London, Ltd.

Meetings of the various classes of shareholders were held on July 29th, Lord Ashfield (chairman) presiding. The purpose of the meetings was to consider and, if thought fit, approve the rearrangement of capital which was outlined in our issue of June 25th, p. 968. Briefly, the scheme provides for the capital of the company to be £5,068,878 in £1 ordinary shares. To effect this the existing ordinary shares are converted, a part of each class being surrendered by the holders, the capital then being slightly increased. Lord Ashfield reviewed the history of the company's capital, and said that in determining the value of the two classes of ordinary shares, Stock Exchange quotations had been resorted to. Under the scheme all arrears of dividend and preferential rights were cancelled and all shares would be of equal value. The object was not only to straighten up the present capital, but regard was paid to future developments. The company would shortly take steps to pay off temporary loans and acquire further interests in the subsidiary companies. He was hopeful that, in spite of the general strike, they would be able to pay a dividend in respect of the current year. The directors wished the scheme to be adopted as a whole; any attempt to vary it to benefit one class would defeat their objects. Resolutions approving the scheme were passed by the holders of the £10 ordinary shares and the 1s. "A" shares, and the chairman intimated that polls would be taken on the resolutions and the results published later. The results were as follows:—£10 ordinary shares: 1,006 shareholders with 102,717 shares voted for the resolution, and 5 holding 113 shares voted against it; 2 did not vote. 1s. "A" ordinary shares: For the resolution 1,199 shareholders with 944,643 shares; against 106 (48,821 shares); 4 did not vote.

Ward and Goldstone, Ltd.

The directors' report for the year ended March 31st last records a net profit of £6,388, after providing for bad and doubtful debts, salaries, depreciation, income tax, etc. To this is added a net balance of £19,913 brought forward, making £26,301. Interim dividends at the rate of 7 per cent. on both the preference and ordinary shares absorbed £7,561, and it is proposed to carry forward the balance of £18,740. The disappointing results are attributed to the general stagnation in trade, particularly in the heavy industries, resulting in a loss of orders; and to over-production and low prices on the part of the company's competitors in the radio trade. The demand and output of insulated wires and cables have been well maintained. Heavy expenses were incurred in the enforced change-over by the Salford Corporation from d.c. to a.c., which necessitated the reorganisation and renewal of the company's electric lighting installation and power plant. Additions to buildings and plant are nearly completed, and the increased efficiency should enable the company to recover prosperity when better trading conditions rule.

Puebla Tramway, Light and Power Co.—The net profits in Mexico during the past year amounted to $1,363,154 (Mex.) as compared with $1,272,584 in the preceding year. The sterling equivalent is £139,155. After meeting expenses, interest, &c., a profit of £14,526 is carried to the balance sheet. The report states that satisfactory services have been afforded the Mexican Railway Co., Ltd., and the Vera Cruz Electric Light, Power and Traction, Ltd. The extension of the electrification of the Mexican Railway to Cordoba is expected to lead to further demands for power.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Committee under Rule 159:—

Brompton and Kensington Electricity Supply.—385 ordinary shares of £1 each, fully paid, Nos. 291,916 to 292,300.

Companhia de Electricidad de la Provincia de Buenos Aires.—348,088 8 per cent. non-cumulative pre-preference shares of £1 each, fully paid, Nos. 1 to 348,088.

Yorkshire Electric Power Co.—The report for the half-year ended June 30th last records the continued growth of the demand, although progress has been checked by the coal dispute. Interim dividends at the rate of 6 per cent. are declared on both preference and ordinary shares. A Bill is to be promoted to increase the nominal capital from £4,000,000 to £6,000,000.

Electrical Distribution of Yorkshire, Ltd.—This company's half-yearly report states that there has been a large increase in the sales of electricity and prices have again been reduced. The interim dividend is 4½ per cent., as against 3½ per cent., free of tax, in 1925. To provide funds for extensions the nominal capital is to be increased from £500,000 to £1,000,000; an issue will be made next spring.

Northampton Electric Light and Power Co., Ltd.—The following interim dividends have been declared:—2½ per cent. on the 5 per cent. preference "B" shares, and 4 per cent. on the ordinary "B" shares. A dividend of 1 per cent. will be payable on the new ordinary "B" shares in accordance with the terms of issue.

Westminster Electric Supply Corporation, Ltd.—An interim dividend of 1s. per share (as last year) is recommended. Mr. Donovan Touche, of Messrs. G. A. Touche and Co., has been elected a director in the place of the late Mr. C. S. Gilman.

Western Union Telegraph Co.—The gross revenue for the six months ended June 30th last was $66,492,828, as compared with $60,088,373 in the first half of 1925. The net income amounted to $7,129,624, as against $7,084,910.

Charing Cross Electricity Supply Co., Ltd.—An interim dividend on the ordinary shares of the West End undertakings for the half year ended June 30th, at the rate of 1s. 6d. per share, has been declared.

Mansfield and District Tramways, Ltd.—The directors state that they are unable to declare interim dividends on the preference or ordinary shares.

Bristol Tramways and Carriage Co., Ltd.—The directors have declared an interim dividend for the half-year ended June 30th at the rate of 3 per cent. on the ordinary shares.

Pettigrew & Merriman (1925), Ltd.—The directors announce that the dividend on the 7½ per cent. cumulative preference shares up to June 30th last is to be paid. They state that, in common with others, the company has been faced with acute depression in the radio industry, but the condition of the company's finances gives no cause for anxiety.

Rushden and District Electric Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 3½ per cent.

City of Buenos Ayres Tramways Co., Ltd.—A dividend of 1½ per cent. has been declared for the quarter ended June 30th.

Southern Railway Co.—The directors have declared a dividend of 2½ per cent. on the preferred ordinary stock.

Stocks and Shares.

TUESDAY EVENING.

LORD ASHFIELD spoke forcefully, at the meeting of shareholders in the Underground Railways Company of London, concerning the effects of the general strike and the subsequent coal crisis. Evidently the company might have been in a position this year to pay, for the first time in its existence, a modest dividend on the shares. But the strike put such a hope out of count; shareholders and employés alike suffer from a strike that was merely sympathetic. Lord Ashfield would hold out no prospect of any immediate dividend on the proposed new £1 shares into which the present shares of £10 and of 1s. are to be converted. The prices gave way as the result

of the meeting, though the 6 per cent. income debentures at 103 are a point to the good.

Metropolitans have fallen 10s.; Districts remain at 51. The dividend announcements of the steam railways are out, and carry no consolation. The London and North-Eastern has decided not to pay the interim dividend on its 5 per cent. preferred ordinary stock. This was a blow, and Home Railways are weak in consequence. London and Suburban Traction preference went back to 5s. London United debenture is left unchanged at 47. British Electric Traction shed 3 points to 73½.

The Westminster Electric and the Charing Cross companies have declared the same interim dividends (1s. per share and 1s. 6d. per share respectively) as those of a year ago. Variations in share prices in this group are limited to rises of 9d. in Brompton ordinary and 6d. in Charing Cross preference. A gain of 1/16 lifted Bournemouth and Poole to 57s. Newcastle-on-Tyne ordinary are dull at 21s. 3d.; the 5 per cent. preference have strengthened to 18s. 9d. It is estimated that two million pounds sterling is likely to prove a low figure for the new generating station projected by the London Joint Electricity Authority, to be erected in Duke's Meadows, Chiswick, well known to Boat Race enthusiasts. The Electrical Distribution of Yorkshire Company proposes to increase its nominal capital from half a million pounds to double that amount.

The Marquis of Winchester, at the Victoria Falls and Transvaal Power Company's meeting, mentioned that the voltage of the newly-completed Witbank station is 132,000, the highest yet employed in South Africa. He pointed out one peculiarity in connection with the company's business, *viz.*, that as a mine became worked out, it was, of course, completely lost as a customer, but that new properties were being constantly opened up as the cost of mining became cheaper. The company is doing a fine and progressive business, and the price of the ordinary shares stands at 54s. 3d. middle.

Cable stocks have reacted a little after their recent very substantial rises, Eastern ordinary, for instance, being 2 points down at 189½. On the other hand, Westerns have gone up ¼ to 18¼, upon appreciation of the fact that the shares are still the cheapest in their own quartette. The Eastern Company is already in the field with invitations for estimates for the erection of a wireless station that will be required in connection with the important concession the company recently secured from Greece, for wireless as well as for cable work, during the next half-century. Anglo-Americans are better, the preferred and deferred both improving.

Recovery has lifted Marconis to 16s. 3d. after the severe drop to 15s. which took place in the shares last week upon the passing of the dividend. The improvement is helped by the announcement that Marconi's have signed a contract with the Bolivian Government whereby the company will control and operate for twenty-five years the postal, telegraph and wireless services of Bolivia. It is obvious that Bolivia has noticed the remarkable improvement that has taken place in the condition of the postal services of Peru since Marconi's took these over five years ago. The impression prevails that at 15s. Marconis touched what is likely to prove their lowest price for some time to come. It is, of course, almost impossible to form any judgment of the value of the shares until the auditors' report is out, and people can see for themselves to what extent the writing-down of capital will have to be carried before the company is placed upon a sound financial basis.

Chili Telephones are 3/16 up at 7 1/16, and United River Plates retain their rise of last week. Telephone Manufacturing new shares are dull at 1s. discount on the shares, 2s. 6d. paid. The next calls, it may be useful to state, are 1s. 9d. on September 15th and 3s. 3d. on December 10th, the latter of which will make the shares fully paid, namely, 7s. 6d. for the 10s. nominal shares.

Siemens have gone back a trifle after their sharp advance, and are quoted at 28s. 9d. British Aluminium weakened to 45s. 9d., and India Rubber shares to 23s. On the other hand, General Electrics are 6d. better at 28s. 9d. The manufacturing market as a whole is steady, but disappointment is felt at the prolongation of the coal dispute, and Babcocks receded to 50s., Armstrongs being 4s. 9d., and Vickers 7s. 9d.

Brazilian Tractions stand out with prominent strength in the foreign transport section. The common shares are 3½ higher at 106; the preferred rose to 109½, and the buying of both classes is largely for Canadian account. Anglo-Argentine Trams have reacted. Mexican Utilities are weak upon reports of religious disturbances which have broken out in Mexico. The issue of £1,275,000 7 per cent. participating debenture stock at 96 in the Perak River Hydro-Electric Power Company was left with the underwriters to the extent of about 80 per cent., and the price of the scrip is 2 discount. Rubber shares have declined in consequence of the exportable allowance for the current quarter having been left at 100 per cent. instead of its being reduced to 80 per cent. in accordance with general expectation.

A further reference to the coal crisis is to be found in the report of the Yorkshire Electric Power Company. The Board reports an increase in demand for current, but adds that business is checked by the dispute in the coal trade. Interim dividends of 6 per cent. are declared upon the company's ordinary and preference shares.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1924	Dividend. 1925.	Price Aug. 3 1926.	Rise or fall.	Yield p.c.
Bournemouth and Poole	1	14	14	57/-	+1/16	4 18 3
Brompton Ordinary	1	10	10	32/3	+6d.	*6 4 9
Charing Cross Ordinary	1	15	15	45/9	—	6 10 10
do. do. 4½ Pref ...	1	4½	4½	17/6	+6d.	5 2 10
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	48/8	—	6 4 4
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15	15	59/6	—	5 0 10
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	24/3	—	6 12 0
do. 7% Pref.	1	6	7	22/6	—	6 4 5
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	1	15	15	13⅜	—	5 9 1
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	32/6	—	6 8 1
do. do. 6% Pref.	5	6	6	5 7/16	—	5 10 8
Metropolitan	1	11	11	37/-	—	5 18 11
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/6	−6d.	5 17 1
Newcastle-on-Tyne Ordinary ...	1	7	7	21/3	−9d.	6 11 9
do. 5% Pref. ...	1	5	5	18/9	+9d.	5 6 8
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.... ...	1	6	6	22/6	+6d.	5 6 8
St. James' and Pall Mall	5	17½	17½	16½xd	—	5 8 6
South London...	1	15	15	2⅝	—	5 14 3
South Metropolitan Pref.	1	7	7	26/3	—	5 6 8
Urban Ordinary	1	4	7	1⅝	—	6 4 5
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	48/3	—	6 18 6
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	26/3	—	7 8 0
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

Home Rails.

Central London Ord. Assented ...	Stock	4	4	70	+1	5 14 4
Metropolitan	,,	5	5	63½	−½	7 17 6
do. District	,,	8½	8½	51xd	—	6 17 3
Underground Electric Ordinary ...	10	Nil	Nil	2½	−⅛	Nil
do. do. "A" ...	1/-	Nil	Nil	10.6	−6d.	Nil
do. do. Income ...	Bonds	6	6	103	+1	*5 16 6

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	104½	+½	5 14 10
do. Def.	,,	1½	1½	24¾	+⅛	6 1 3
Automatic Telephone	1	3	6	2½	—	4 0 0
Chili Telephone	5	5	6	7 1/16	+1/16	*4 4 11
Cuba Sub. Ord.	10	5	5	6⅞	—	7 5 6
Eastern Extension	10	10	10	11⅛	—	*5 4 8
Eastern Tel. Ord.	Stock	10	10	189½	−2	*5 5 6
Globe Tel. and T. Ord.	10	10	10	19⅛	—	*5 4 8
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel....	10	22	20	27	—	7 7 1
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi...	1	10	Nil	16/3	+1/16	... ...
Marconi Marine	1	10	7½	1 1/16	+1/16	7 1 2
Oriental Telephone Ord.	1	12	12	45/6	+6d.	*5 5 6
United R. Plate Tel....	5	8	8	8 3/16	—	*4 17 9
Western Telegraph	10	10	10	18⅞	+¼	*5 7 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8	−⅛	9 3 4
do. do. 2nd Pref. ...	5	6	6	2⅛	—	10 18 4
do. do. 5% Deb. ...	Stock	5	5	73½	−1	6 16 1
British Electric Traction Ord. ...	,,	7	8	134½	−3	5 18 11
do. do. 6% Pref. ...	,,	6	6	110	—	5 9 1
Brazil Traction	100	4	5	106	+3½	4 14 3
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	86½	—	5 15 7
do. do. Preferred ...	,,	96/-	126/9	107½	—	*5 17 11
do. do. Deferred ...	,,	129/5	8	134	—	*5 9 5
do. do. Deb. ...	,,	4½	4½	79	—	5 7 7
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	5/-	−6d.	Nil
London United Tram. Deb. ...	Stock	4	4	47	—	8 10 2
Mexico Trams 6% Bonds	—	5	5	71½	—	6 19 10
Mexican Light Common	100	Nil	Nil	31½	−1	Nil
do. Pref.	100	Nil	Nil	63½	−2	Nil
do. 1st Bonds	—	5	5	71½	−1	6 19 10
Yorkshire (West Riding)	1	5	—	11/6	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	12	12	50/-	−1/-	*5 4 0
British Aluminium Ord.	1	5	10	45/9	−1/-	4 7 5
British Elec. Transformer Pref. ...	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	2⅝	—	4 8 11
Brush Ord.	1	10	10	1½	—	6 0 0
Callenders	1	15	15	3½	—	4 12 4
do. 6½% Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	13/3	—	... ...
Edison-Swan	4/-	10	10	11/-	—	3 12 9
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	32/-	—	6 0 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 8 4
English Electric	1	5	Nil	13/9	—	... ...
do. do. Pref.	1	6	6	18/-	—	6 13 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	24/9	+6d.	5 4 4
Henley	1	16	20	3½	—	5 8 3
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber...	1	5	5	23/-	−9d.	*4 6 11
Johnson & Phillips	1	10	17½	63/-	—	5 11 1
Met.-Vickers Ord.	1	8	8	24/6	—	6 12 0
do. Pref.	9	8	8	2⅜	−⅛	6 14 9
Siemens Ord.	1	7½	7½	28/9	−9d.	5 4 4
Telegraph Construction	12	20	10	20	+½	*4 9 9

*Dividends paid free of Income Tax

South African Trade Statistics.

THE following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1925, has been compiled from the recently-issued official trade statistics. The figures for 1924 are added for purposes of comparison, and notes of any increases or decreases are made.

	1924.	1925.	Inc. or dec.
Electrical cable and wire—	£	£	£
Total	360,000	596,000	+236,000
From Great Britain	324,000	567,000	+243,000
,, United States	9,000	4,000	– 5,000
,, Germany	12 000	20 000	+ 8,000
,, Belgium	2,000	2,000	—
Heating and cooking apparatus—			
Total	36,000	36,000	—
From Great Britain	23,000	24,000	+ 1,000
,, United States	8,000	4,000	– 4,000
,, Germany	5,000	6,000	+ 1,000
Meters, electric—			
Total	33,000	29,000	– 4,000
From United Kingdom	18,500	21,500	+ 3,000
,, Germany	10,000	5,000	– 5,000
,, United States	4,000	1,000	– 3,000
Insulators, porcelain—			
Total	11,000	21,000	+ 10,000
From Great Britain	9,000	19 000	+ 10,000
,, United States	500	250	– 250
,, Germany	1,500	1,400	– 100
Insulators, all other—			
Total	9,000	5,000	– 4,000
From Great Britain	7,000	4,000	– 3,000
Electrical material, other—			
Total	39 000	33,000	– 6,000
From Great Britain	23,000	20,000	– 3,000
,, United States	7,000	7,000	—
,, Germany	6 000	5,000	– 1,000
,, Switzerland	1,000	—	– 1,000
,, Czecho-Slovakia	—	800	+ 800
Electric hand lamps—			
Total	7,000	14,000	+ 7,000
From United Kingdom	1,500	1,700	+ 200
,, Germany	2,000	2,700	+ 700
,, United States	2,000	8 000	+ 6,000
Other electric lamps, globes, bulbs, &c.—			
Total	112,000	162,000	+ 50,000
From United Kingdom	37,000	90,000	+ 53,000
,, Austria	4,000	4,000	—
,, Germany	11,000	14,000	+ 3,000
,, Holland	25,000	33,000	+ 8,000
,, United States	30 000	16,000	– 14,000
,, China	2,500	3,000	+ 500
Electric lighting outfits, self-contained—			
Total	8,000	19,500	+ 11,500
From United Kingdom	5,000	2,000	– 3,000
,, United States	2,500	16,000	+ 13,500
Wireless apparatus and parts—			
Total	285,000	102,000	–183,000
From Great Britain	264,000	84,000	–180,000
,, United States	6 000	7,000	+ 1,000
,, Germany	5,000	4,600	– 400
,, Denmark	1,300	1,700	+ 400
,, France	2,500	1,500	– 1,000
,, Holland	1,400	1,600	+ 200
Telegraph and telephone material—			
Total	39,000	34,000	– 5,000
From Great Britain	17,000	16,000	– 1,000
,, Sweden	3,000	2,000	– 1,000
,, United States	3,000	6,000	+ 3,000
,, Czecho-Slovakia	2 000	—	– 2,000
,, Belgium	12,000	1,500	– 10,500
Batteries, primary—			
Total	31,000	22,000	– 9,000
From Great Britain	8,000	8,000	—
,, United States	17,000	10,000	– 7,000
,, Sweden	1,000	—	– 1,000
,, Denmark	3,000	1,500	– 1,500
Batteries, secondary—			
Total	58 000	38 000	– 20,000
From Great Britain	25,000	8,000	– 17,000
,, United States	24 000	23,000	– 1,000
,, Germany	8,000	6 000	– 2,000
Dynamos and generators—			
Total	30,000	70,000	+ 40 000
From Great Britain	24,500	64,000	+ 39,500
,, Germany	2,000	3,000	+ 1,000
,, United States	3,500	3 000	– 500
Transformers—			
Total	64 000	114,000	+ 50,000
From Great Britain	51 000	102,000	+ 51,000
,, United States	8 000	7 000	– 1,000
,, Germany	4 000	1,000	– 3,000
Motors—			
Total	167,000	146,000	– 21,000
From Great Britain	88,000	102,000	+ 14,000
,, United States	47,000	17,000	– 30 000
,, Germany	9,000	16,000	+ 7,000
,, Holland	2,000	3,000	+ 1,000
,, Sweden	14,000	5,000	– 9,000
,, Denmark	2,000	2,000	—
Electrical machinery, other—			
Total	554,000	789,000	+235,000
From Great Britain	365,000	592,000	+227,000
,, United States	101,000	83,000	– 18,000
,, Germany	51,000	64,000	+ 13,000
,, Sweden	3,000	10 000	+ 7,000
,, Canada	16 000	16 000	—
Tramway rails—			
Total	14,000	15,000	+ 1,000
From Great Britain	14,000	—	– 14,000
,, United States	—	9 000	+ 9,000
,, Germany	—	5,000	+ 5,000
Tramway rolling-stock—			
Total	25 000	12,000	– 13 000
From Great Britain	11,000	6 000	– 5,000
,, United States	14,000	6,000	– 8,000
Other tramway materials—			
Total	55,000	35,000	– 20,000
From Great Britain	45 000	24,000	– 21,000
,, United States	9,000	10,000	+ 1,000
,, Germany	—	760	+ 760
Engines, oil, petrol and spirit—			
Total	57,000	47,000	– 10,000
From Great Britain	50,000	41,000	– 9,000
,, United States	4 000	5,000	+ 1,000
,, Germany	1,000	1,000	—
,, Sweden	1,000	—	– 1,000
Engines, steam and gas—			
Total	50,000	105,000	+ 55 000
From Great Britain	45,000	103,000	+ 58,000
,, United States	1,500	1,000	– 500
,, Germany	1,000	600	– 400

In addition to the above the following goods were imported as "Government stores":—

Batteries, primary—			
Total	1 500	1,500	—
From Great Britain	1,200	1,000	– 200
Batteries, secondary—			
Total	5 000	2,500	– 2 500
From Great Britain	4,500	1,000	– 3,500
,, United States	—	400	+ 400
,, Germany	500	—	– 500
Heating and cooking apparatus—			
From Great Britain	300	490	+ 190
,, United States	—	100	+ 100
Insulators, porcelain—			
Total	7,500	2,800	– 4,700
From Great Britain	1,600	2,400	+ 800
,, United States	4,000	300	– 3,700
Insulators, other—			
Total	15,000	2,000	– 13 000
From United Kingdom	1,000	2,000	+ 1 000
,, United States	14,000	—	– 14,000
Motors and parts—			
Total	4,000	1,000	– 3,000
From Great Britain	4,000	1,000	– 3,000
Dynamos and generators—			
Total	700	6,700	+ 6 000
From United Kingdom	700	6,000	+ 5,300
Transformers—			
Total	64,000	1,000	– 63,000
From United Kingdom	1,000	1,000	—
,, United States	63,000	—	– 63 000
Electrical cable and wire—			
Total	201,000	101 000	–100,000
From Great Britain	175,000	79 000	– 96,000
,, United States	—	3,500	+ 3,500
,, Canada	22,000	6,500	– 15,500
,, Denmark	3,000	10,000	+ 7 000
Telegraph and telephone material—			
Total	270,000	190,000	– 80,000
From Great Britain	210,000	153,000	– 57,000
,, United States	10 000	13,000	+ 3,000
,, Sweden	30,000	15,000	– 15,000
Electrical machinery, other—			
Total	1,139,000	141,000	–998,000
From Great Britain	1,005 000	133 000	–872,000
,, United States	121,000	3,000	–118,000

The Trade Position in Spain.

A Highly-Protected Market.

A REPORT upon the industries and commerce of Spain, prepared for the Department of Overseas Trade by Capt. U. de B. Charles, C.B.E., Commercial Secretary at Madrid, has now been issued.*

The report, which is dated April 6th, 1926, says that during 1925 Spain was practically free from internal political and industrial disturbances, although the Morocco question had its effects on the debt of the country. The Budget deficit was reduced, as was the adverse balance of trade, but Spain still has a long way to go before her industries can prosper without that degree of protection which to many appears to be contrary to the principles of economics. Nevertheless, it is largely as a result of the protective tariffs, the subsidies to industries already established, and grants in aid of new industries that Spain has built up her production. The spirit of nationalism has left its mark on Spanish trade with other nations and the United Kingdom, as a free-trade country, suffers most from this, and future developments, Capt. Charles thinks, are likely to further hinder trade between this country and Spain. The country is capable of, and undoubtedly needs, great development, but progress must be slow until there is a general speeding-up of administrative methods. The economic situation has improved, and the termination of the Moroccan hostilities should enable national activities to receive that share of the country's wealth which they so badly need.

Foreign Trade.

In 1925 Great Britain retained its position as Spain's principal customer, the value of purchases remaining at the 1924 level of about £19,650,000. At the same time, this country ceded the position of chief supplier to Spain to the United States.

As regarded the imports of electrical and allied goods during 1925, the United Kingdom held the lead in only one class—electric cables. Of these we supplied 490 tons out of a total of 1,139 tons of cables exceeding 1 cm. in diameter. The total imports of dynamos, alternators, &c., fell from 5,479 tons in 1924 to 5,290 tons in 1925. Of this, 1,480 tons came from Germany, 1,140 tons from the United States, 730 tons from France, and 530 tons from the United Kingdom. Out of a total of 199 tons of electrical meters, Germany supplied 124 tons. The United Kingdom provided 89 tons of accumulators, as against 96 tons from the United States and 68 tons from France, while imports of electric batteries were nearly all from the last country. Imports of dry batteries rose from 178 tons to 405 tons, 167 tons coming from Denmark, 112 tons from Germany, and 50 tons from Norway. There was also a substantial increase in the imports of telegraph and telephone apparatus—from 165 tons to 365 tons; of this France supplied 97 tons, Belgium 66 tons, the United Kingdom 53 tons, the United States 39 tons, and Sweden 35 tons. The United Kingdom also supplied 100 tons of electrodes, as against 118 tons from the United States, and shared the trade with the latter country and Germany in insulating fabrics and tapes. In a small import of steam turbines, Switzerland maintained her lead in the lighter classes and the United States in the heavier types.

Metal Production.

The output of lead ore and silver lead has progressively increased in the last three years. Complete figures for 1925 are not given, but it is stated that the production of lead in the Linares district rose from 87,450 tons in 1924 to 103,800 tons in 1925. The value of the ore produced reached 10 million pesetas in 1924, representing the second highest value in Spanish mineral production.

According to official figures, in 1924 the output of cupreous pyrite was 1,615,233 tons, the output of copper ore being 283,866 tons. In 1925 shipments of pyrites from the port of Huelva amounted to 2,292,226 tons, of which 846,591 tons was cupreous, the balance being sulphurous. In 1924 the production of copper, including blister, bars, and electrolytic copper, amounted to 36,346 tons, rather less than 9,000 tons below the production for 1923.

The total production of zinc in 1924 amounted to 116,721 tons, of which over 65,000 tons came from the province of Santander. The only figures available for 1925 are those which show an output of 75,335 metric tons for the same province, of which all except 10,000 tons was exported. The production of metal was 12,777 tons in 1924, as against 6,000 tons in 1913.

Hydro-Electric Development.

Owing to the lack of reliable statistics, it is difficult to arrive at an accurate estimate of Spain's potential hydro-electric resources. A fairly reliable authority places these at from six to ten million h.p.; the actual capacity of stations at the end of 1925 was between one and one and-a-half million h.p. Many of these stations are reduced to very low water supplies during the summer months, and the most important companies have found it necessary to install steam stand-by plant. The scarcity of capital during 1925 left its mark upon the development of the hydro-electric industry, which requires a very large capital outlay as a rule. The hydro-electric energy produced is accounted for as follows:—Loss in transmission, 17 per cent.; traction, 20 per cent.; lighting, 20 per cent.; and industry, 43 per cent. The outstanding development during the year was the granting of a concession to the Sociedad Anónima Canalización y Fuerzas de Guadalquivir for the establishment of eleven hydro-electric stations on the Guadalquivir between Seville and Córdoba. The scheme includes the building of a reservoir at Gandula, north-east of Córdoba, with a capacity of 400 million cu. metres. The State, in addition to granting a subvention of 50 per cent. of the estimated cost of the reservoir, will advance 40 per cent. of the total cost of the scheme at an interest of 1½ per cent. per annum. It is estimated that the reservoir and power stations will develop 75,000 h.p. when completed, although for the present it is proposed to build only the reservoir and the first station, at Alcalá del Rio. Arrangements have been made with the Sevillana de Electricidad, the C. A. Mengemor, and other important electricity companies for the consumption of the power generated. A number of undertakings were added to or completed during last year, including the following:—The Villalba de la Sierra plant, which it is anticipated will develop a mean of 15,000 h.p., and which transmits its energy at 60,000 V to the Unión Eléctrica Madrileña's station at Bolarque, a distance of 65 km. The Hidroeléctrica del Cantábrico (Asturias) has completed an 11-km. canal to supplement the water available at the Somiedo fall, which will now produce 14,000 h.p.; two 50,000-V transmission lines are in course of construction. The Tambre undertaking of the Gallega de Eléctricidad was expected to be in operation by June, producing 7,500 h.p. during the summer and 16,000 h.p. during the rest of the year. The Riegos y Fuerza del Ebro, in conjunction with the Unión Eléctrica Catalana, has carried out works on the Pyrenean lakes which should provide a reserve of 50 million kWh, saving the consumption of some 45,000 tons of coal. The Hidroeléctrica Ibérica is adding a reservoir of 5½ million cu. m. capacity to its system; this company has a capital of 135 million pesetas. The Hidro-eléctrica Española has increased the capacity of its Villova (Cuenca) plant to 47,400 h.p., and it is estimated that by the close of the current year the company will be developing 114,000 h.p. The Cia Anónima Mengemor has added to its plant and has constructed a 25,000-V transmission line. There is still no definite information as to the development of the Douro Falls, and work has not yet commenced on the Alberche Fall, near Avila.

Railway Electrification.

Early this year a new line from Zumárraga to Zumaya, 37 km. in length, was opened. The line, which is an electric one, connects Zumárraga with the Bilbao-Las Arenas line, and serves two popular summer watering places. The motor coaches for the system were built by the S.A. Siemens-Schuckert Industria Eléctrica in its Barcelona workshops. The electrification of the Bilbao-Las Arenas line, which is being carried out by a German firm, should be completed by August, 1927. The failure of the company' bank has delayed the work of electrifying the Bilbao-San Sebastian line, but it is hoped to commence the work at an early date. Work has been continued on the branch line of the Gran Metropolitano de Barcelona, S.A., and the section from the Plaza de Cataluna to the port will shortly be opened to the public. The other underground railway in Barcelona is nearly completed. The municipality has decided to spend 50 million pesetas on a tunnel for the section of the Barcelona-Sarria line which at present runs through the streets. Tenders for this have been invited from Spanish firms. Two new lines were opened by the Madrid Underground Railway, but the construction of the other sections has been suspended for the present.

Methods of Business.

Capt. Charles says that it mu t be regarded as an axiom that to secure foreign trade a close preliminary study of the customs, usages, and conditions generally of the market aimed at is indispensable. This rule applies pre-eminently in a tariff-protected and custom ridden country like Spain. The Spanish are intolerant with regard to badly-written letters in their own language, and the same remark applies to catalogues, &c. Representatives should be able to speak Spanish and should be acquainted with the psychology of the people. Another way of securing a share of the Spanish trade is by co-operation with Spanish firms. Not a few British concerns have found it advantageous to establish factories in Spain, securing Spanish capital and Government support and protection.

*Stationery Office. 2s. 6d. net.

Notes from New Zealand.

Hydro-Electric Power Development.

(From Our Special Correspondent.)

AMONGST the 15 districts into which the Dominion has been divided by the Public Works Department, which administers the hydro-electric power development in New Zealand, Canterbury leads, in respect of actual power in use, with 16,000 h.p., followed by Otago with 12,500 h.p., Southland with 10,250 h.p., and Auckland South with 10,150 h.p.; whereas in 1903 only 9,900 h.p. was actually in use; by 1913 the amount had risen to 35,000 h.p., and in 1925 to 70,150 h.p.

Government Expenditure.

Up to the end of last financial year the Government had expended over £4,000,000, and had progressed but a fraction of its way towards its goal of 160,000 h.p. of installed capacity in the North Island and 110,000 h.p. in the South Island, by which it is estimated to save 1,000,000 tons of coal out of a total annual consumption of 2,400,000 tons for the whole Dominion. The head works' cost is undertaken by the Government, and the reticulation costs fall on the Power Boards, of which there were thirty-nine constituted by the end of March, 1925, and thirty of them had started construction, involving an expenditure of nearly £6,000,000. The general result of the business of the Power Boards has been a profit of only £22,800. This apparently poor result is, however, regarded as satisfactory, for losses in the early stages are considered inherent in the beginning of any concern depending to such an extent on a large initial capital outlay to earn a revenue which takes time to develop.

Nitrate Manufacture.

Last year a large commercial project was launched with a view to developing the water power of the scenic Bowen Falls for the manufacture of atmospheric nitrates, and it was not until the scheme was almost completed that a storm of public protest against the destruction of one of the beauty spots of Milford Sound was launched with such vigour and persistence that the Government finally refused to grant the necessary licence for the project to be put into operation. Bowen Falls have been saved for the time being to the Tourist Department, but other less known falls in the vicinity of Dusky Sound and Deep Cove have come under the notice of the commercial syndicate, and a licence has been issued authorising the development of two large schemes by "The New Zealand Sounds Nitrates Syndicate," under the direction of Mr. J. Orchiston, A.M.Inst.C.E., to utilise the existing falls in Deep Cove, on Doubtful Inlet, and to cut a tunnel through the mountains into Lake Manapouri.

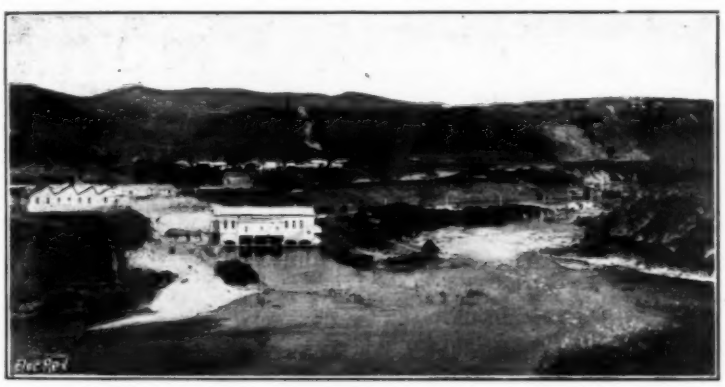


Fig. 1.—Intake at Hora Hora Rapids, Waikato River, N.Z.

The programme of the Syndicate provides for the initial development of 50,000 h.p. in Deep Cove from the existing water power there, and for the discharge of Lake Manapouri into Smith Sound to develop a further 250,000 h.p., making the total output of the scheme some 300,000 h.p., which will be by far the largest hydro-electric development south of the equator.

The Government licence provides that the minimum development of the first project must exceed 25,000 kW within seven years, or, as an alternative, have had a sum of more than £100,000 spent upon it. A second stipulation is that the major project shall develop not less than 50,000 kW within fifteen years, in default of forfeiture of the licence. The Government also requires an assurance that the cost of power to purchasers at the Syndicate's power house shall not exceed one penny per kWh, and the Syndicate will be required to protect all wild bird and animal life as well as natural bush within its area of operations.

One of the schemes in the Government's hydro-electric schedule is the Lake Manapouri scheme, in which the waters of this 50-sq.-mile lake would be utilised from the available head of 600 ft. and 8,500 cusecs to develop approximately 630,000 kW. This scheme was the second largest in the official programme, the largest being the adjoining Lake Te Anau scheme, where 12,630 cusecs at an available head of 700 ft. were estimated to develop 1,200,000 kW.

The project, as outlined by the Nitrate Syndicate, departs materially from the proposed Government scheme, as the total power to be developed by the Syndicate from both its sources is only 300,000 h.p., or considerably less than half the Government's projected output from Lake Manapouri alone. It is not anticipated that the development of the Syndicate's schemes will in any way interfere with the general programme of the Government in this area, as the total available power is greatly in excess of the anticipated demands of the whole Dominion over a long period of years.

The Syndicate's scheme for Deep Cove aims at utilising the power in a 3,000-ft. fall of water close to a 300-acre flat, where a power house and village could be erected close to deep water, over 20 fathoms being recorded within a chain of the beach, and the Cove is well sheltered from the weather and open to the sea through an easily navigable, but tortuous, channel. The major scheme includes the piercing of a tunnel, 6½ miles long and 30 ft. between the linings, from the Sound into Lake Manapouri, whose surface is some 600 ft. above sea level at Smith Sound, thus securing some 8,500 cusecs for the development of 250,000 h.p.

Recently, as the result of a geological reconnaisance, it was discovered that a very extensive deposit of high-grade marble exists within a short distance of Smith Sound, and analytic tests proved a 98 per cent. content of carbonate of lime. This grade of stone is a necessary concomitant to the successful production of high-grade nitrates and its occurrence is therefore a decided advantage to the Syndicate.

The estimated cost of power from the completed scheme is £1 5s. per horse-power, which figure compares very favourably with the average cost of power from the installed Government schemes where the figure is approximately £5 10s. per horse-power. The Sounds project is easily the largest scheme in the Southern Hemisphere, and it is the intention of the promoters to commence the initial work immediately. It is not anticipated that the final scheme will be completed within the next ten years, but it is expected that it will be finished well within the Government's stipulated time.

The Hora Hora Scheme.

The Government hydro-electric station at Hora Hora, on the Waikato River, is situated not far from the scene of the Arapuni project, and is now loaded beyond its full capacity of 10,300 kW.

Originally the Hora Hora undertaking was constructed for the supply of electricity for the Waihi Goldmining Co.'s works, and consisted of six generating sets of a total capacity of 6,300 kW. When the station was purchased by the Government from the Goldmining Co., the head-race was enlarged and two additional 2,000-kW sets were installed, and at the present time the plant is not only supplying the requirements of the Goldmining Co., but is providing the Auckland Power Board with 2,500 kW during the day and 3,000 kW at night.

The undertaking originally consisted of a simple weir, which diverted the required amount of water into the headrace, leaving the remainder to flow over the spillway. As a result of the heavy demands now being made on the scheme, however, it is intended to utilise the spill water for the further generation of electricity, and the rubble weir has already been raised some 5 ft. above the original level. This is now found to be inadequate, and the resident engineer is engaged upon the building of a concrete dam, which should be completed in about six months' time. In some respects the dam at Hora Hora is unusual, as it does not run straight across the river, but forms the two arms of a right angle, one connecting the river bank and the other pointing upstream and lying almost in the centre of the river. This peculiarly constructed dam contains three distinct types of gates, each of which is 50 ft. wide: One is a vertical movable gate hung on piers rising about 10 ft. above the 18-ft. sills, and is equipped with a heavy counterbalance which enables it to be operated by one man; the other two gates are both automatic in action and are controlled by the rise and fall of the water level in the dam acting upon floats within the water chambers situated inside the piers. The dam is just over 300 ft. in length.

In the construction of the new dam some difficulty has been experienced in dealing with the flood waters, which have been unusually heavy during the construction period. The wastage water has been diverted into the opposite half of the flood

channel, partly by the use of trees and partly by low groynes. One particularly heavy flood in the Waikato completely enveloped the new diversion tunnel at the Arapuni works, and swept on down the river into the Hora Hora construction work, with disastrous results. The timely action of the engineer in felling *pinus-insignis* trees into the river to divert the water, probably saved the whole works from almost total wreckage.

Although there is nothing colossal about the Hora Hora works, it was one of the first hydro-electric schemes to be established in New Zealand, and its successive enlargements supply an interesting object lesson in the growth and development of hydro-electric ideas. The construction of the new dam is considered one of the most " ticklish " jobs a power contractor could wish for. A view of the intake at the Hora Hora Rapids is shown in fig. 1.

The Arapuni Project.

The first section of the Arapuni scheme, which is intended primarily to supply the City of Auckland, will contain three 15,000-kW generators, and provision will be made for an additional machine of the same size and also for the duplication of this plant at a later date. Ultimately the station will contain eight machines of a total installed capacity of 120,000 kW. The transmission to Auckland City, a distance of over 100 miles, will be effected at 110,000 V, three-phase. The first of the high-pressure lines has been completed between Hora Hora and Auckland, over which the temporary Hora Hora supply is at present being transmitted. Ultimately there will be five similar transmission lines penetrating into the whole of the Auckland province from Arapuni, and linking the two other major stations in the North Island scheme, Lake Waikaremoana and Mangahao.

Fig. 2.—Lake Coleridge Power Station.

A sub-station has been installed at Bombay, where the pressure is stepped down to 11,000 V for a supply to Tuakau and to the Franklin Power Board; a similar procedure will be followed at the sub-stations of the Distributing Boards. From Bombay a line is being run to Waikino to link with the line from McLaren Falls at Tauranga, and also with the present line from Hora Hora to Waihi.

To maintain a constant pressure on the five main e.h.p. lines, four synchronous phase-modifiers, each of 10,000-kVA capacity, will be installed at the Penrose sub-station near the city of Auckland. These machines will be controlled by automatic pressure regulators and will operate in conjunction with similar regulators at the main power house at the Arapuni Rapids. A master clock will be installed in the power station by means of which the frequency will be controlled at a constant rate, and arrangements are being made for synchronous motors to be connected with the driving mechanism of all recording instruments, so that uniformity of readings may be obtained throughout the system at the same moment.

The contract for the Arapuni project is in the hands of the Armstrong-Whitworth Company, and is due for completion by the middle of 1928, when it is expected that the first section (60,000 kW) will be available for the use of Auckland City and the district adjoining. The estimated cost of Arapuni undertaking is £4,500,000.

Dunedin City Council's Waipori Scheme.

The Waipori Electric Power Act, authorising the development of the Waipori Falls, was passed in 1904, and the scheme was later taken over by the Dunedin City Council. The present plant capacity is 12,000 kW, but provision is being made for its extension to 25,000 kW in the near future, the city of Dunedin and some of the surrounding districts and towns being supplied from this undertaking. Water is conducted from a number of artificial lakes through a tunnel and pipe lines to the power house, which is situated at the foot of a narrow ravine where a fall of 700 ft. is available. The Waipori River is little more than 30 miles long, but during part of its course towards the sea it drops through a vertical distance of 1,200 ft. in a horizontal equivalent of 11 miles, and at the steepest part of this fall there is a 700-ft. drop in less than two miles; it is at the lowest point of this steep drop that the plant has been established.

The installing company originally decided upon an initial plant of two 3-phase, 50-cycle, 1,000-kW units, but on several occasions since then additional plant has been provided. In 1909, and again in 1913, two additional 1,000-kW units were installed, bringing the total capacity at the latter date up to 6,000 kW; since then the original plant has been replaced by two 3,000-kW sets, thus conserving floor space while increasing the total capacity to 10,000 kW.

The energy is generated at 2,400 V and transmitted at 35,000 V over 33 miles of double transmission lines to Dunedin. It is then distributed at 6,600 and 3,300 V, at which pressures it is tapped at various points along the route to supply the country needs. The transmission lines are built on separate hardwood poles and run parallel 50 ft. apart, with 150-ft. spans between the poles. The main sub-station is at Halfway Bush, where the first step-down occurs.

The present storage capacity is maintained by the dams at Loch Louden and Lake Luella, which together conserve approximately 3,500 acre-feet. The dam at Loch Louden is earth filled and has a puddled-clay core, 50 ft. from the spillway, while the Lake Luella structure is an arched concrete dam 41 ft. from the spillway; the latter dam was erected at a cost of £7,420, or £3,000 more than that of the Loch Louden structure. To prevent any possibility of a water shortage, and to develop the Waipori scheme in its entirety, the Dunedin City Council has definitely decided to put in hand the construction of the larger Mahinerangi dam, which will reach a height of 110 ft. above the present water level of the stream. This dam will be situated at an ideal spot, for at 60 ft. above the stream level the width of the valley is only 130 ft., and both banks are of solid rock. With the completion of this dam the storage area capacity will be approximately 200,000 acre-feet, 15 miles long, and there will be sufficient water to provide 27,000 h.p. on a 50 per cent. load factor with the present installed plant. Already the structure is assuming appreciable proportions, the top being some 50 ft. above the stream bottom, and stretches about 120 ft. across the valley. At the apex the solid wall of concrete is 16 ft. thick, and about twice that thickness where it penetrates into the solid rock beneath the stream bed. The cost of the complete structure is estimated at about £70,000.

Lake Coleridge Duplication.

The demands upon the original 12,000-kW plant at Lake Coleridge have been so heavy that the duplication works are being pushed on as rapidly as possible, and it is anticipated that the total capacity of 36,000 kW will be available before the end of 1926.

The present plant is under an almost continuous overload, the peak running up to 15,000 kW frequently. The City of Christchurch and the towns of the Canterbury plains are increasing their hydro-electric demands at such a rate that there are already serious suggestions to the effect that the Government should be requested to put into operation one, or more, of the subsidiary schemes on the official programme for the future. One suggestion is that the Government should take in hand at once the scheme at Lake Tekapo, near Fairlie, which will provide some 300,000 kW. Fig. 2 is a view of the power station, and in connection with the extensions referred to a contract for the supply of two 7,500-kW alternators was placed with Messrs. Bruce Peebles & Co., Ltd., and one alternator was dispatched some months ago; the second machine, fig. 3, has passed the required tests and has been shipped. The machines are designed to operate at a 0.85 power factor and to generate three-phase energy at 50 cycles, and a pressure of 6,600/7,000 volts when driven at a normal speed of 500 r.p.m. They are of the totally-enclosed, forced-ventilated type, the cooling air being provided by induction-motor-driven fans. The fan motors are of the Peebles standard squirrel-cage protected type, the fan in each case being mounted on an extension of the motor shaft. Each alternator has two main bearings of the forced lubricated type, the oil pump being driven by belt from the main shaft. A hand-operated pump is provided on each machine for flushing the piping and bearings prior to starting up.

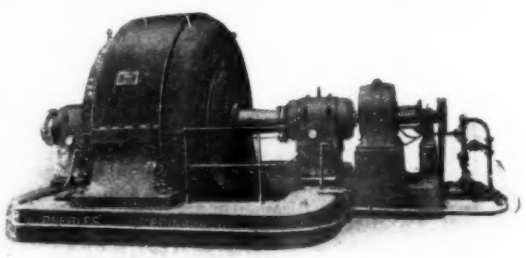


Fig. 3.—Bruce Peebles Alternator for Lake Coleridge Plant.

The water turbines to which the alternators will be coupled

direct have a runaway speed of 80 per cent. above normal, which speed the alternators have been designed to withstand. The contract includes the supply of oil tanks and strainers, oil coolers, with water tanks, and all the auxiliaries necessary for the successful operation of the plant.

It is of interest to note that Messrs. Bruce Peebles, to whom we are indebted for the above particulars, supplied the original generating plant which has been in successful operation for many years.

Lake Monowai Power Plant.

The Monowai plant, which supplies the Southland Power Board and, incidentally, the city of Invercargill, generated 774,530 kWh during January, an increase of 51,810 kWh over the previous month. A new oil-cooling system has been installed and the auxiliary Reyrolle transformer panel and the necessary cable to duplicate the present lead between the switchboard and the 66,000-volt transformer have now been installed, while the additional switchgear for the Winton, Invercargill, and Gore sub-stations has arrived from the Metropolitan-Vickers Co., and is being installed.

Grey Power Board.

The power house building is now complete, and the erection of the sub-stations is well in hand. The Chapel Street sub-station has been practically completed; the transmission line between the power station and city of Greymouth has been completed after being held up for want of delivery of poles. The work of erecting street lights and minor reticulations is proceeding satisfactorily.

Wanganui-Rangitikei Power Board.

Working on supplies of power from the Government scheme at Mangahao, the Wanganui-Rangitikei Power Board is responsible for the distribution of power over the whole of the area between the two rivers of their respective names, the mountains on the one hand and the sea on the other. This area of 1,200 sq. miles has a scattered population, mostly involved in farming operations, and minor reticulation is a big job. The total amount of loan money expended to the end of 1925 was £353,564, and an additional sum of £60,000 was to be required in April last. Power from the Board's recently acquired steam plant at Wanganui has been sold to the Westmere consumers and the woollen mills in the river city, and it was expected that power from Mangahao* would be available by the beginning of March.

Electrification of N.Z. Railways.

Messrs. Merz and McLellan, the London consulting engineers, have forwarded their report on the proposed electrification of N.Z. railways to the local Railway Department, where it has been before the Prime Minister as Minister of Railways, and the technical heads of the Railway and Public Works Departments for consideration. It is understood that it is proposed to electrify several of the suburban sections, including the Auckland-Newmarket and Wellington-Hutt lines, and some suggestion is made that certain sections handy to existing electric power plant be put in hand as well.

* ELEC. REV., April 30th, 1926, p. 692.

Explosive Reactions in Gaseous Media.

A Faraday Society General Discussion on the Subject.

A GENERAL discussion on the above subject, under the auspices of the Faraday Society, recently took place at the Institution of Mechanical Engineers in London. The programme was divided into two parts, the first dealing with explosive reactions generally, while in the second explosive reactions were considered with reference to internal-combustion engines; in all there were about a dozen papers falling within the two categories.

Explosive Reactions Considered Generally.

Among the papers contributed was one by Prof. W. T. David (Professor of Engineering, University of Leeds) on the subject of radiation in gaseous explosions, in the course of which he discussed the effect of infra-red radiation upon the combustion of gaseous mixtures containing nitrogen. Recent experiments had shown that the rate of combustion of certain gaseous mixtures might be speeded up by passing infra-red radiation into them before explosion. The mixtures used in the experiments consisted of hydrogen and air, carbon monoxide and air, and methane and air, and from the results it was inferred that the rate of combustion was increased when the infra-red radiation introduced into the gaseous mixture just before and during combustion was of the kind absorbed by the combustible gas. In mixtures of CO and air the introduction of 4.6 μ radiation, which was absorbed by CO, speeded up combustion, though the introduction of other kinds of radiation had no effect upon the rate of combustion. In CH_4-air mixtures, the introduction of 3.2 μ radiation, which was absorbed by CH_4, increased the rate of combustion; while in mixtures of hydrogen and air infra-red radiation of any kind had no effect on the rate of combustion, presumably because hydrogen had no absorption bands in the infra-red region of the spectrum. In experiments he had carried out in conjunction with Messrs. G. S. Richardson and W. Davies he had since found that when the nitrogen of the air in such mixtures was replaced by argon, oxygen, carbon dioxide, or the combustible gas itself, the introduction of radiation into the reacting system appeared to have little or no effect on the rate of combustion. From these experiments it was clear that radiation had an appreciable effect on the rate of combustion only when nitrogen was present as a constituent of the inflammable mixture.

The subject of ionisation in gas explosions was dealt with in a paper by Messrs. W. E. Garner and S. W. Saunders, the tentative conclusions drawn by the authors from somewhat scanty data being (1) that ionisation occurring in gaseous explosions was mainly thermal in character, although from the measurements of ionisation at room temperature it was not improbable that a small fraction of the ionisation was due to the chemical change; (2) ionisation played no part in the ignition of gases; (3) the hypothesis that the ionisation of the gas in front of the explosion was the cause of the propagation of the detonation wave appeared to have been disproved, although Malinowski's investigations rendered this conclusion somewhat uncertain; and (4) the action of anti-knocks and knock inducers in a petrol engine could not be satisfactorily explained by the theory of Wendt and Grimm.

Mr. S. C. Lind (Associate Director, Fixed Nitrogen Research Laboratory, U.S. Department of Agriculture, Washington), in another paper, concluded that, from the experiments conducted by various investigators, while there might have been some reasons for supposing gaseous ionisation to be the cause of the rapid propagation of gaseous explosions, or of flame detonation, no conclusive evidence had ever been found for that theory, and the present trend of support was toward purely thermal propagation.

The Propagation of Flame.

An easy method of finding a measure of the rate of propagation of flame during the initial period, which is applicable to a considerable extent in the electrical industry, was described in a paper by Prof. R. V. Wheeler and Dr. W. Payman. The method consisted of measuring the speed of uniform movement, and not only was it a direct method of measurement, but the measurements could be obtained again and again with perfect accuracy. At the beginning of the travel, the flame moved at a uniform speed, which was measured by taking a photograph of the flame moving along the tube on a revolving photographic film. In this way a whole series of values for different gas mixtures could be obtained, which were the means of determining the inflammability of different gases during the slow-combustion period. The main applications of such determinations were in the realms of safety in mines, and it was in this connection that the experiments were carried out. The measurement of the slow movement of flame, said Dr. Payman, was of importance, for example, in the design of safety lamps, because if ignition occurred inside a lamp the explosion began with a moving flame which moved at approximately the speed of uniform movement. In the initial stages of fire-damp explosions, uniform movement had again to be considered, whilst such determinations were also of very great importance in connection with the design of flameproof switchgear. One could get some measure of the effect likely to be obtained in enclosed switchgear from a knowlege of the uniform movement of flame.

Dr. FRASER (Department of Chemical Technology, Imperial College of Science and Technology) doubted that uniform movement could be considered as a physical constant. Not only did the diameter of the tube alter the supposed speed, but the means of ignition, the temperature, the material of which the tube was made, and other factors, not quite so obvious, also altered it. Therefore, when stating uniform movement as a physical constant, surely all the conditions should be stated. He also mentioned experiments which showed that if two gases of the same speed were mixed, the speed of the mixture was less than that of the original mixtures independently.

Dr. PAYMAN, in reply to this point, agreed that it might not be wise to consider uniform movement as a "physical" constant, but certainly it was constant. He disagreed that the speed of uniform movement depended on the spark; it had been shown definitely that it did not. Provided it was ignited at the open end of the tube, no matter what was used, the uniform movement of the flame would always be the same. In a paper he had published so far back as 1920 he had stated that, on mixing gases of the same speed, the speed of the mixture was slightly less than the speed of the original gases, and to explain it he had tried to show that the law of mass action appeared to play some part in the propagation of flame during the slow uniform movement.

In the course of a paper on explosions in petrol engines, Mr. H. T. TIZARD said that the petrol engine, judged by other present-day standards, was already an extremely efficient machine; yet anyone discovering a practical method of so controlling the rate of combustion of fuels as to enable the average expansion ratio of petrol engines to be raised from, say, 5 : 1 to 7 : 1, an alteration which involved little or no engineering difficulties, would save the country in time several million pounds a year.

Speech Projection in Large Buildings.

The "Standard" Public Address System in Liverpool Cathedral.

IT is unfortunate that the very features which contribute most to the interior beauty of cathedrals and large churches, such as piers and arches, alcoves, and lofty vaulted roofs, are the cause of the poor acoustic properties of such edifices.

Fig. 1.—The Lectern, showing Microphone.

Echo and reverberation are inseparable from the accepted standards of church architecture, and one of the most successful methods of improving the intelligibility of speech in such buildings is that of electrical voice projection, the advantages of which are clearly demonstrated in Liverpool Cathedral, wherein No. 2 "Public Address" equipment was originally installed by Standard Telephones & Cables, Ltd., temporarily for the consecration ceremony.* The system proved so successful, however, that the cathedral authorities decided to have the apparatus permanently installed.

There are two permanent microphone positions, one of which is at the lectern, fig. 1, and the other at the bishop's throne, while arrangements have also been made so that a microphone may be placed on the high altar when required. The brackets which carry the microphones and their mountings are of special design and have been given a special dull-copper finish in order to harmonise with other metal fittings in the cathedral, and all the wiring has been entirely hidden.

The amplifying system, together with the associated equipment, are housed in the basement, the arrangement of the amplifier, batteries, loud-speaking monitor, and the battery-charging board being shown in fig. 3. The cabinet is 6 ft. 6 in. long by 6 ft. high by 2 ft. deep and has swing doors in front and a removable door at the back, so that all parts of the equipment are readily accessible. The charging board, which is shown on the right of the picture, is mounted on the wall and so arranged that by simply throwing three switches the low-voltage, high-voltage, and grid batteries are placed on charge, and meters are provided for checking the charging currents at any time and the voltage of any of the three different batteries.

Eight voice projectors are at present connected to the system; they are of a special design expressly for church work and are of the folded, or box, type, as illustrated in fig. 2. Three projectors are arranged in such a way as to cover the choir and sanctuary, the fourth projects the voice into the memorial chapel transept, another into the south-eastern transept, and two more into the area beneath the lectern, and another serves the annexe off the south-eastern transept.

After a great deal of experiment the correct position for each voice projector was found so as to give the best result. The average height of the projectors above the ground is 25 ft., and they are attached to the columns, or walls, by means of brackets fixed into the masonry; the projectors and brackets are painted the same colour as the stonework so that they are not in any way conspicuous.

Fig. 2.—Voice Projectors at Side of Chancel

Fig. 3.—Amplifying and Battery-charging Equipment.

The cabling which runs to each of the loud-speakers is not visible, as it has been carefully embedded in the cement between the slabs of stonework. The total amount of cable used on the system amounted to over 2,500 ft., the majority of which runs underneath the floor of the cathedral on lengths of wood

* ELECTRICAL REVIEW, September 5th, 1924.

fitted to the walls. Where it was essential for cable to cross from one side of the cathedral to the other it was necessary to run it in the concrete airducts, which are only just large enough to permit a small man to crawl through. The difficulty of running the cable was also increased by reason of the fact that cable from the microphones must not run in the same duct as cable leading to the voice projectors, so that it was necessary to find an alternative route and use another airduct for running this part of the cable.

Two special telephones are also fitted, one in the south transept and the other in the choir, which connect with the operator at the amplifier; observations may be passed to the operator so that he may make the necessary adjustment to the system. The degree of amplification obtained can be controlled very simply to meet the varying conditions, such as the size of the congregation and the characteristic qualities of the speaker's voice, merely by turning a rotary switch on the amplifier.

The "Public Address" system installed in a church or cathedral is found by the preacher to surprisingly reduce the strain upon his voice; relieved of the effort of making himself heard, the speaker can focus his attention on his message, and to an even greater extent amplification relieves the strain of listening and concentrates attention on the service. The visible parts of the system do not detract in any degree from the cloistered beauty of the church interior, so skilfully can they be mounted.

Breakdowns and Failures of Electrical Plant.

Insurance Company's Report.

We have received a copy of the Technical Report for 1925 of the British Engine, Boiler and Electrical Insurance Company, Ltd. It contains descriptions of many of the breakdowns of electrical and allied plant which were brought under the company's notice during the year, and the following notes concern some of the cases which we have selected as being of interest to electrical men. The report also contains an interesting article on "Resistance, Capacity and Inductance in Parallel," by Mr. L. W. Schuster, M.A.

A number of cases of mechanical breakdowns on turbo-generators are reported. In one machine, a 1,500-kW Curtis-Rateau type mixed-pressure turbo-generator, 3,000 r.p.m., three vanes were found broken out of the nozzle block of the velocity stage. The rotor contained a velocity-compounded impulse wheel with two rows of moving buckets, followed by four impulse wheels, each with a single row of buckets. The block was of cast iron, in which the steel vanes were cast when the metal was poured. The buckets and the shrouding of the first three wheels were of phosphor-bronze, and of the last two of mild steel. The exhaust steam entered between the first and second wheels. The broken-off portions caused considerable damage to the first row of buckets of the velocity stage, and lesser damage to succeeding buckets.

The trouble was caused by erosion, the steel vanes being worn to a knife edge and so thin that particles of the metal were torn away; in addition, the cutting action of the steam had deeply scored the segment casting. The trouble was caused by the wetness of the steam; a certain amount of sediment was also carried over from the boilers and collected on the blading, and, being carried over in a finely divided state, passed readily through the perforated strainer which was contained in the stop valve.

Another interesting case was where two turbine blades were broken off at the roots. The machine was a 750-kW, mixed-pressure turbo-generator of the disk and drum type, 2,400 r.p.m. The turbine contained a velocity wheel with two rows of impulse blading followed by five groups of reaction blading. The last group of blading consisted of three rows made of brass, and ran at a mean speed of 302 ft. per sec. and a tip speed of 374 ft. per sec. The exhaust steam was admitted between the velocity wheel and the drum portion of the turbine. The machine failed to give its full output and was opened up for examination. An adjoining blade was also found badly bent, a portion of shrouding, 2 in. long, being broken off. The other blades of this row, and the blading of the following two, were damaged by the parts broken off, the shrouding, also, in each case being damaged. The rotor blading was found in a very dirty condition, a black greasy deposit from the exhaust steam having gathered on the second row of the impulse running blading, the blades being blocked up near the shrouding to a depth varying from ⅛ in. to ¼ in.; this accumulation had taken place owing to the turbine having been run normally without the use of live steam. The drum portion contained a similar deposit and the guide blading was also dirty. The exhaust steam from auxiliaries was fed into the turbine without passing first through an oil separator. This omission allowed an oily deposit to accumulate at the shrouding of the running blades, and it was there that the trouble originated. The accumulation of deposit probably threw the rotor out of balance, and as it had suffered previously from vibration when other rows were damaged, the failure evidently resulted from fatigue.

In a 1,250-kW impulse-type turbo-generator, 3,000 r.p.m., which was constructed with nine mild-steel disk wheels, it was found that cracks had developed in the first disk wheel. This was of conical profile with a double taper which changed in the neighbourhood of the hub. The latter was clear of the shaft at the centre portion but was secured against circumferential movement by two sunken keys. There was partial admission of steam at the first stage, which contained two sections of fixed nozzles, one at the top and the other at the bottom of the casing. The disk proper ran at a peripheral speed of 500 ft. per sec. The cracks were circumferential in direction and extended from the edge of one of the holes for withdrawing the disk, and travelled for a distance of 6 in. on one side of the hole and 1¼ in. at the other. Both cracks were visible on each side and travelled along the line of junction where the tapered profile changed, fig. 1. Calculations showed that the natural periodicity of the disk per minute when vibrating on one nodal diameter was 6,100, and when vibrating on two nodal diameters 6,380, or only 6½ per cent. more than the frequency of the impulses given by the steam from the nozzles. The disk evidently had been in a state of vibration and fouled the nozzles, indications being given by the marking both along the side of the disk rim and at positions diametrically opposite one another on the nozzle ring and close to the nozzle sections. The tendency for the formation of a crack was aggravated by the unsatisfactory

Fig. 1.—Crack in Disk Wheel.

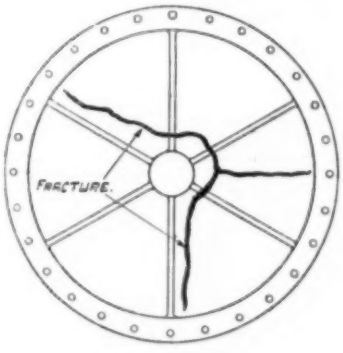


Fig. 2.—Condenser-cover Fracture.

design and material of the disc. On analysis it was found to have a low sulphur and phosphorus content, the sulphur present being .02 per cent. and the phosphorus .053 per cent.; it also gave satisfactory sulphur prints, showing absence of segregation. When examined microscopically, it was found to consist of good clean metal, but its structure was altogether unsuitable, being that of a severely overheated material. Although the ductility shown by a static test appeared satisfactory, the defective nature of the material and its inability to withstand shock were shown up in a marked manner by an impact test. The vigilance of the engineer in charge, who discovered the damage, averted an inevitable catastrophe, and the case exemplifies the advisability of periodical inspections being made.

The following is illustrative of a type of trouble caused by unsatisfactory design. The machine in question was a 1,600-kVA turbo-generator with nine impulse disks, 3,000 r.p.m. The casing was of cast iron, both the top and the bottom being continuous, and an annular passageway for the inlet steam contained in the high-pressure end near the outside periphery formed part of the main castings; the casing end, both at the top and the bottom, was stiffened by two ribs, 1 in. thick and 4⅛ in. deep, which extended from the annular steam passage to the gland sleeve, each rib making an angle of 60 degrees with the flanged joint of the turbine casing. The top half of the casing was renewed five years previously owing to cracks having been set up in it at the exhaust end. Cracks developed in the top casing, at the extremities of the ribs adjoining the gland sleeve, penetrating the full depth of the ribs; these were 25 mils open at the outside edge of the ribs with the turbine at work, but were hardly noticeable with the turbine at rest. The cracks had extended into the

body of the end casing, where they were to be traced on both sides of each rib travelling round the fillet adjoining the gland sleeve. While being kept under observation, they were seen to be rapidly extending until they met finally at a point midway between the ribs, the overall length of the extended defect being 9¼ in. The cracks in the ribs themselves did not constitute any element of danger, but having penetrated into the body of the end casing, they were liable to still further, and serious, extension owing to the breathing of the end casing in consequence of temperature changes. The presence of the ribs, which should not have been there in the first instance, now actually brought into being a great element of weakness, as it enormously intensified the stress across the crack round the fillet. It was arranged, therefore, that the ribs should be cut away almost entirely, the affected part being removed completely and the remainder generously rounded off. As the cracks fortunately did not penetrate deep into the fillet, the bordering metal was cut out and a continuous rounded surface formed at the outside of the casting, the remaining metal being of ample section for strength; the actual thickness of the casting was ¼ in. more than was intended by the designer. It was considered that, with the stress removed thus from the bottom of the fillet, the trouble would be overcome. The turbine has run for over twelve months since the repair without showing any signs of further trouble.

In one instance the cover of the condenser of a 375-kVA reaction-type turbo-generator burst. The condenser was of the surface type, and the two-throw air pump was of the Edwards type, with buckets 11 in. by 9 in., and was driven at 100 r.p.m. through gearing by an electric motor. The pond, from which the circulating water was obtained, was some 400 ft. away; the surface of the water being about 80 ft. above the bottom of the condenser, the pressure there, with friction, was 42 lb. per sq. in. The water was conveyed by a 6-in. pipe line to the bottom of the condenser, and the upper end of a siphon pipe was connected to the top of the condenser. The lower end was connected to a centrifugal-type pump which circulated the water back to the pond through another 6-in. pipe; the topmost part of the pipe was 20 ft., and the mouth of the pipe about 8 ft. above the water-level of the pond. The suction pipe had, at the inlet end, a swivel joint to which was attached a float for keeping the mouth of the pipe 2 ft. below the surface level of the pond, a strainer being fitted at the bottom. The strainer had to be cleaned every few days, as it was apt to become almost choked with twigs and leaves, when a complete stoppage of the water drawn by the pump was caused. A pipe, equipped with a ball valve, was led off from the bottom of the suction pipe at a point between the suction valve and the pond for supplying water to a boiler feed tank; consequently, whenever a partial stoppage of the strainer occurred, or the pressure at the suction of the pump became abnormally low from other causes, there was always a danger of air being drawn into the condenser, past the ball valve. Load had been thrown off the turbine, and the condensing plant was being shut down with the turbine still running and exhausting to atmosphere, when the accident occurred. It is believed that the inlet valve to the condenser was either being closed or had just been closed, and that the switch controlling the pump motor was either knocked out or a circuit breaker came out. The circulating pump was designed for working against a head of 100 ft., but under actual working conditions the head did not approach this figure, the pump only having to overcome the friction within the waterways; with the feed valve fully open, this resulted in the quantity of water circulated being considerably more than that intended. A 7-in. suction pipe should have been used. For these, among other reasons, there was an abnormal friction loss in the suction pipe, the pressure at the condenser inlet falling to 10 lb. per sq. in. with the pump at work at its ordinary speed. When load was thrown off the turbine the speed increased by 14 per cent., and that of the pump increased proportionally; on these occasions the velocity of flow in the suction pipe was still further increased, with the result that the pressure at the condenser inlet fell to 5 lb. per sq. in. under normal conditions, or even lower if the conditions were abnormal, and the supply to the boiler feed tank stopped, leading to a possibility of air being drawn in past the ball valve. As the usual practice was for the attendant to close first the suction and then the delivery valve, before stopping the pump, there would be normally only a small pressure on the water heads of the condenser. If, however, the pump were switched off suddenly with the suction and the delivery valves open simultaneously, not only would the condenser water heads have to withstand the increased static pressure, but, in addition, the pressure rise consequent to the sudden checking of a 400-ft. column of water flowing at an excessive velocity. If the delivery valve were open with the suction valve shut, and a stoppage of the pump took place at a time when there was an air lock at the top of the siphon bend, there would also be a hammer blow from the column of water in the rising main. Fig. 2 shows the damage to the cover.

Some examples of insulation failures on turbo-generators are also given. In the case of a 1,250-kVA four-pole turbo-generator, a short-circuit developed between two adjacent end connectors at the turbine end of the stator winding, six end connectors being burnt through, and one of the ¾-in. round bars severely damaged. The end connectors were distorted and nearly all the small string binders securing the fibre distance pieces between the end windings were strained and broken. At the exciter end one of the joints was melted, and the insulation of the rotor winding damaged as a result of the arcing. There was an excessive leakage of steam from the sealing gland at the exhaust end of the turbine, which was drawn by the ventilating fan into the inside of the generator, where it condensed on the end windings, and caused the string binders holding the wood distance pieces between the end turns to perish and break. This and a certain amount of vibration at the generator end of the set caused one of the packing pieces to come adrift and movement of the conductors on either side to follow. The connectors, made damp by the steam from the gland, came into contact and the inevitable arc took place.

In another instance the insulation of the shunt coils of a small generator was found to consist of a number of layers of millboard cemented together with sulphur cement which, with the vibration of the machine, had become loose, mixed with the field windings, attacked the untinned copper, and caused deterioration of the insulation. When points on the insulation, 3 in. apart, were touched with connections from a lamp on a 250-V circuit, the lamp lit, and sparks jumped along the portion of the insulation which formed the circuit. Insulating formers should not be made with a cement containing sulphur, as there is always danger of the sulphur becoming disintegrated and attacking the insulation.

A frequent cause of breakdowns on d.c. machines is the accumulation of conducting deposits behind the commutators. In a 500-kW rotary converter, 1,040 A, 480 V, d.c., arcing was noticed near the commutator; the machine was shut down, and it was seen that six armature conductors were burnt away at a part adjacent to the end of the supporting ring for the front end winding. The neighbouring commutator risers were damaged, and also the mica insulation of the supporting ring and at the back of the commutator. A quantity of dust was found to have collected on the underside of the front end winding, and this had led to the short-circuiting of the winding between the conductors, and to arcing. The dust on the armature, which owed its origin to the graphite brushes, being of a greasy nature, adhered to the conductors readily, and rendered the cleaning of the machine a somewhat difficult procedure. The machine could, however, have been kept in a cleaner state if it had been periodically blown out with compressed air, and the dust sticking to the front end of the conductors released by the winding being given taps with a light mallet.

Another instance of faulty design was where a "short" developed between the phases on the rotor of a 750-h.p. slip-ring-type induction motor, 400 V, 3-phase, 50 cycles. The trouble was found at a point where the starting coil of one phase and the finishing coil of another crossed. It could be seen that the end windings, which projected 5¼ in. from the core, had sprung outwards at both ends of the rotor owing to the absence of any support, no winding carriage being provided. Flexible cables were also used for connecting the windings to the slip-rings. As the motor was urgently required, additional insulation was inserted between the top and the bottom sections of the rotor coils, and new binding bands were fitted. With a view to the slip-ring leads being made more rigid and the end winding more secure, the flexible leads to the slip-rings were replaced by copper strip. The trouble was overcome completely by this change of construction, and the motor has run, subsequently, for a period of sixteen months, in a perfectly satisfactory manner.

An interesting case of slip-ring trouble is reported on a 100-kW, four-pole rotary converter, converting six-phase, 50 cycle, a.c., at 160 V, to d.c. at 220 volts. There were six slip-rings, each with two brushes spaced 90 degrees apart, and of 32 by 25 mm. cross-sectional area, the current density being 91 A per sq. in. Four distinct flats 90 deg. apart developed on one ring and two on an adjacent one. The machine was in order otherwise, and the load not excessive. The slip-rings were re-skimmed, and two axial hacksaw cuts made across the face of each slip-ring brush; this, however, did not stop the trouble, and the flats re-appeared with resultant sparking; other rings also were affected. It was considered that the flats were produced according to the Hunter-Brown quasi-electrolytic theory (the transference of metal from the ring surface in the direction of the current flow), and it was recommended that the number of brushes should be increased from two to four per ring with the pairs spaced accurately at the same angle (electrical) from one another.

The next case represents a failure caused by carelessness in erection. On a 30-b.h.p. slip-ring induction motor, 415 V, three-phase, 50 cycles, fitted with brush-lifting and short-circuiting gear, a partial open circuit was found at a point where two phases of the rotor winding were connected together. The joints had been made by bunching four conductors together—two in parallel from each phase—into a ferrule. Two conductors from one phase, which were unsweated, had been moving inside the ferrule. One of the slip-rings was noticed to be considerably grooved, causing the brushes to chatter. It had been observed, prior to the repair, that the periodicity of the swing of the ammeter needle coincided with that of the belt fastener when it came in contact with the motor pulley. After the open circuit was repaired and the slip-rings were smoothed up, the motor was run up under full load conditions, and it was seen that the swing of the needle had ceased. The jar of the belt-fastener passing over the pulley evidently had caused movement of the loose connections in the rotor, the resultant current variation being reflected in the swing of the ammeter needle.

Many instances of boiler troubles are given. In one, a back header cover of a power station boiler was blown off. It was discovered that the internal clamp had failed completely along

a line following the boundary of the bolt head. The material was found to be of good quality and free from important defect or segregations of impurities. A certain amount of pitting was seen at the bolt hole, but no trace of a corrosive attack on the metal, either here or at the surfaces. The clamp had evidently failed from mechanical causes, as a result of being overstrained at some period or other of its history when the joint was made. The conclusion was reached that it was highly dangerous to continue utilising the other clamps on the boiler, and immediate arrangements were made, therefore, for their renewal. The boiler was 20 years old.

The following case illustrates the disabilities to which a certain type of spring-loaded safety valve is liable. A cast-iron saddle heating boiler, six years old, working under a head of water of 11 ft., was proposed for insurance. The surveyor found that the safety valve was fast on its seat, and on releasing it, with a pair of pliers, he discovered that the spring failed to exert any pressure on the valve. As the boiler was not at work the water was run off and the valve removed. It was then found that the nature of the rubber insertion between the valve face and the seating had perished, and that the spring was destroyed by corrosion, evidently brought about by persistent leakage past the valve. Fig. 3 shows the condition in which the spring was found. The valve was immediately replaced by one of the dead-weight type, with metal-to-metal contacts. The spring was made of

Fig. 3.—Corroded Valve Spring.

steel instead of bronze, as is customary in valves of this type, but whether it was the original spring or a replacement is not known.

Of the tube failures in boilers, one is reported in connection with a modern 160-lb. boiler containing 100 horizontally inclined tubes. Trouble was experienced from the bulging of the tubes in the bottom row, opposite the hottest part of the furnace. One, which actually failed after only nineteen days' service, was found to contain a continuous bulge, 3 ft. 6in. long, over the fire, the bulging being fairly uniform, and resulting in the tube diameter being increased by ¼ in., at the point of greatest distortion; this tube opened out longitudinally, at the centre of the bulged portion, over a length of ¼ in. The tubes, which were hot solid drawn and made by a well-known manufacturer, were free from visible fault, either of material or of workmanship. Microscopic examination showed that they were made of a low-carbon steel, free from important impurities or defects, which was suitable in every way for tube manufacture. In addition, strips of metal cut circumferentially and longitudinally could be bent till the sides touched. At the inside, oxidisation had taken place uniformly over the bottom surface, and a hard layer of magnetic iron oxide, 1/32 in. thick, could be chipped off,

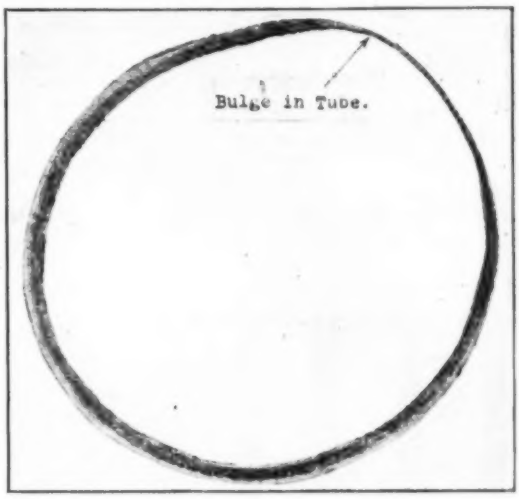


Fig. 4.—Bulged Boiler Tube.

leaving the surface exposed perfectly smooth. At the outside, a rough magnetic iron oxide scale, appearing like clinker, was adhering to the bottom surface, and under the microscope oxidisation could be seen taking place along the grain boundaries. In the case of the older tubes, overheating from intense local heat had been aided by the presence of a thick scale from the water, and, again, the action of steam, formed under the scale, had resulted in the formation of a thin film of magnetic oxide. Analysis of the scale failed to show any trace of grease. A water-softening plant was installed, and, up to the time of the publication of the report, no further trouble had been experienced. Fig. 4 shows a section of the tube in which the drawn out metal at the bulge is clearly discernible.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Armoured-cable Tool.

A description is given in *Power* of a tool recently developed by the Triangle Conduit, Inc., Brooklyn, New York, designed for the quick and clean stripping of the steel wire from armoured cables without danger of injuring the conductors or the insulation. The tool, fig. 1, consists essentially of a pair of 11½-in. pliers, fitted with corrugated jaws to hold the cable,

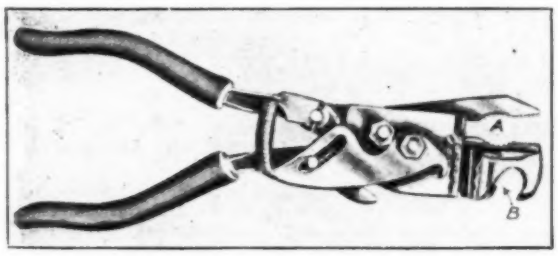


Fig. 1.—Armour Stripping Tool.

and a device for parting the steel. It is fitted with wide-mouthed pliers A and a cutting device B. The tool is designed to strip cables of a wide range in size without adjustment.

A Bakelite Adaptor.

One of the most recent productions of the GENERAL ELECTRIC Co., LTD., Magnet House, Kingsway, W.C.2, is the Bakelite adaptor, the main feature of which is its compactness; little more than half the size necessary for the ordinary adaptor is required to ensure the main qualities of the best devices of this form. Fig. 2 shows the "Magnet" B.C. adaptor with the cover removed. It is provided with large and substantial elliptical contacts, an effective cordgrip, specially designed heavy terminals to prevent the

Fig. 2.—Bakelite Adaptor (Full Size).

wires becoming guillotined, a high bridge between the terminals, and fixed cross pins. It is claimed that the adaptor is practically unbreakable, and that, owing to the exactitude of the moulded threads, there is no danger of the covers shrinking on to the base or cracking, as is frequently the case with wood adaptors. The device is made in two styles, with holes in the cap of ¼-in. or 5/16th-in. diameter, for light or heavy flexible cords, respectively.

A Colliery Winding Signal Indicator.

There has just been completed by the Automatic Telephone Manufacturing Co., Ltd., Strowger Works, Liverpool, a colliery winding signal-indicator of record capacity, which is designed to register signals from five distinct levels, including bank and bottom, and provides for no less than 20 signals per level, or 100 in all. It had been manufactured to the order of Messrs. Lambton Hetton and Joicey Collieries, Durham, and will shortly be installed in the winding-engine room of their Silksworth Colliery, making the fifth A.T.M. winding signal indicator to be supplied to this well-known colliery group. As the illustration (fig. 3) shows, the indicator is designed and constructed on the standard A.T.M. luminous-screen principle, the opaque glass panels being normally blank, and the individual orders and numerals standing out in luminous stencil. The 20 panels for each level are arranged vertically as shown, the mechanism being housed under the rectangular cover seen below each section. There are only six relays and two selector switches associated with each level, the whole of the complex system of signals being controlled by this comparatively simple combination of electro-mechanism. Cancellation of the signals is effected by a small dynamo driven by the winding engine, and is controlled by a common group of five relays. The company's usual practice has been followed by arranging for the cancellation of "action" signals at the commencement, and warning "MEN" signals at the conclusion of a wind. The vitally important indication that men are riding is thus maintained in full view of the winder during the whole time the engine is in motion. Moreover, should the warning "3" be sent during a wind (as is the practice in many collieries, to save time when a shift is being brought to the surface, or is going below), the "MEN" signal will remain displayed throughout the succeeding wind, instead of being cancelled with the stoppage of the engine as would otherwise be the case. Of the first five statutory signals, the first panel "1" is subdivided as shown, and indicates "Raise" or "Stop," respectively, according to the condition of the winding engine at the time the signal is sent, *i.e.*, whether stationary or in motion.

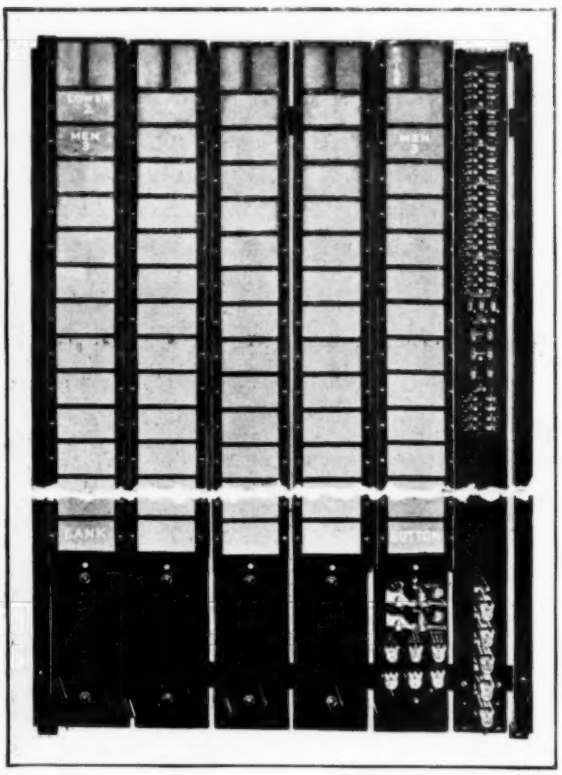


Fig. 3.—Colliery Indicator Screen.

An Electric Die-stock.

Some particulars are given in the *American Machinist* of an electrically operated die-stock which has been introduced by the Oster Manufacturing Co., Cleveland, Ohio, for threading ⅜-, ½-, and ¾-in. pipe. The diehard is driven by a 110-V universal motor, which, with a gear-reduction unit, is enclosed in an aluminium alloy casing. A separate diehead is used for each size of pipe; a pawl arrangement holds the head to a rotating sleeve and renders the change of heads simple. The dies are adjustable so that over- and under-size threads can be cut as well as the standard size. The pipe, which is held stationary, is centred by means of a universal chuck, which, it is claimed, quickly affords proper alignment. A switch for starting, stopping and reversing the motor is suitably placed on top of the device.

Reviews.

Introductory Electrodynamics for Engineers. By E. Bennett, E.E., and H. M. Crothers, Ph.D. Pp. ix + 665; figs. 306. London: The McGraw-Hill Publishing Co., Ltd. Price, 22s. 6d.

This book deals with work which in this country would perhaps be described as magnetism and electricity, and the mode of treatment incorporates several distinctive features. The authors are of the opinion that at least three types of instruction in electrotechnical work are desirable, these being suitable for very capable and deeply interested men, moderately capable and moderately interested men, and for men whose interest in the subject is of a secondary nature respectively. Those engaged in a professional capacity in connection with electrical engineering will come within the two first named classes, and it is for those falling within the first class that the book has been written.

The authors point out that electrical engineers meet with three systems of units, the electrostatic system, the electromagnetic system, and the practica[1] system, and their mode of treatment is to use a definition for the practical unit of electrical charge based upon the usual definition for the electrostatic unit of charge, but also incorporating a constant which has been determined experimentally, and from this to derive the definitions of the practical units of all other quantities (including those concerned with electrostatics and magnetics) considered. They are led to this mode of treatment by the fact that unit charge would seem to be of a more fundamental nature than unit pole and it leads to the elimination of the more usual definition of the last mentioned quantity. Another feature in connection with the treatment of units is that the constant π is eliminated from certain of the more common magnetic formulæ by the adoption of the so-called rationalised units for magnetomotive force and magnetic force.

The question as to the best form of treatment of units would seem to be attracting considerable attention in scientific engineering circles in America at the moment, and it is to be hoped that the good resulting from a full discussion of the difficulties of the subject will not be accompanied by confusion in the minds of students owing to various authorities on the subject advocating and using different modes of treatment. Since units commonly used in different branches of technology have originally been based on different fundamental ideas, difficulties and objectionable features are bound to arise when attempts are made to link them together, and it would certainly be helpful to have an agreed standard mode of treatment. Further, since the same units are used by all classes of engineers, it would seem desirable that the difficulties should be relegated as far as possible to those units which are least used by the practical man and these are the units dealing with electrostatic conceptions. Practical engineers are constantly using the units dealing with the electromagnetic quantities, and it is with such units that simplicity and clearness are fundamental requirements. The position hardly seems to be satisfactory at the moment, and whether or not the method put forward by the authors will tend to the desired end can only be ascertained after a reasonable experience in the use of the method advocated in the book.

In regard to the actual contents of the book we find that electrostatic phenomena are first dealt with, followed by a detailed consideration of the flow of current in conductors, particular attention being paid to the use of Kirchhoff's laws in the more complicated networks. Forces on current-carrying conductors are next described and this matter, under the scheme used, leads up to magnetic calculations and the production of electrical pressures on the dynamo and transformer principles. The final chapter deals with the propaganda of electrical effects through space.

The treatment throughout is of a mathematical nature, which is perhaps evidenced by the fact that the last formula in the book is numbered 632, and special commendation may be made of the fact that every care is taken to bring home clearly to the reader the distinctions between definitions, experimentally determined relationships, and deductions. We have been impressed and interested by the thoughtful and suggestive mode of treatment, and it is a book which should be perused by all who are interested in the teaching of electrical engineering.

Elementary Electrical Engineering. By O. R. Randall, Ph.D., B.Sc. Pp. vi + 233; figs. 177. London: Sir I. Pitman & Sons, Ltd. Price, 5s. net.

This is an excellent little text book for students taking a lecture and laboratory course up to the first National Certificate in Electrical Engineering. An elementary knowledge of Physics is assumed, but in the first three chapters the author goes through the fundamental principles of electricity and magnetism so that there may be no doubt about the basis upon which the later chapters are founded.

The feature of the book is the unique combination of lecture and laboratory work, the relevant schemes for the latter being set out in the form of tests at the end of each chapter. As examples of this we may quote the series of experiments planned to illustrate the subject matter of the chapter on Energy and Power; these are (i) measurement of power in a single-phase circuit, (ii) experiment with an ampere-hour meter, (iii) experiment on the relation between the Joule and the gram-calorie. On the direct current armature we have the

following experiments: (i) distribution of flux round the air gap of a dynamo, (ii) effect of armature reaction, (iii) voltage loss due to brush contact, (iv) measurement of resistance of an armature. It will be seen from these examples that the author has been at some pains to ensure that students shall gain a fair acquaintance with practical measurements while they are studying the principles of electrical phenomena and machinery. The omission of the Hopkinson test from the experiments upon loaded d.c. machines is singular and a little unfortunate.

The minor criticisms we would offer relate to the inclusion of such semi-defunct apparatus as the hot-wire ammeter, and the cursory treatment of so important a subject as alkaline accumulators opening with the sentence: "Secondary cells having an alkaline electrolyte are used for certain purposes." The word *force* is omitted after electromotive in the list of contents.

The book is well printed and illustrated, and adequately fulfils its purpose. It is sufficiently cheap to permit any electrical apprentice to add it to his bookshelf and contains enough excellent matter to keep him busy for a whole winter.

P.H.S.K.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Remuneration of Electrical Engineers.

How to earn a living out of engineering has exercised the minds of thousands since the war. Some of us, including the writer, are too old to make a change and must perforce struggle on. There is one trade, however, wherein even a mediocre individual can earn a livelihood. I mean plumbing. The plumber is certain of a good living, not so the electrical engineer; and if he does not like his designation he can call himself a "Sanitary Engineer." Had I any sons they should all be plumbers before engineers, electrical or mechanical.

A.M.I.E.E., A.M.I.Mech.E.

Manchester, *July 30th*, 1926.

The article and letter which have appeared in recent issues of the ELECTRICAL REVIEW raise a point which has been in the minds of many, and I suppose the engineer of to-day who is not worrying about his rate of remuneration is the exception.

The isolated position of the average electrical engineer of to-day is lamentable. The majority do not belong to any association, and if they do, it is usually to one which does not concern itself with the economic problems of its members.

The everyday development of industry is, however, emphasising more than ever the necessity of membership of some association which will enable the engineer of to-day to exchange views with others engaged in the same profession. It is important that the engineer who desires to progress should take advantage of any facilities offered to keep up to date with modern practice and improvements, and particularly those engineers engaged on electrical work.

For the practical man, who has also received a technical training, there are associations which provide a medium through which he can improve his knowledge. Their educational and social facilities give him the opportunity of widening his field of knowledge, broaden his outlook and bring him in contact with electrical engineers on all classes of work.

The need for close association among engineers responsible for valuable electrical plant, and men, is of vital importance, but they belong to a professional class who have too long stood aloof from their fellows. Their position, generally, during the recent industrial trouble, was one of embarrassment, except where they were members of an association to which they could appeal.

Doctors, lawyers, and other professional men have long ago recognised the need of organisations to protect their professions, and if the engineers engaged on electrical work are not to be left behind in the rapid progress which industry will make in the next few years, they must also get together for the sake of themselves and their profession.

A. Brammer,
General Secretary, National Association of Supervising Electricians.

London, *July 30th*, 1926.

The Lee Network Box.

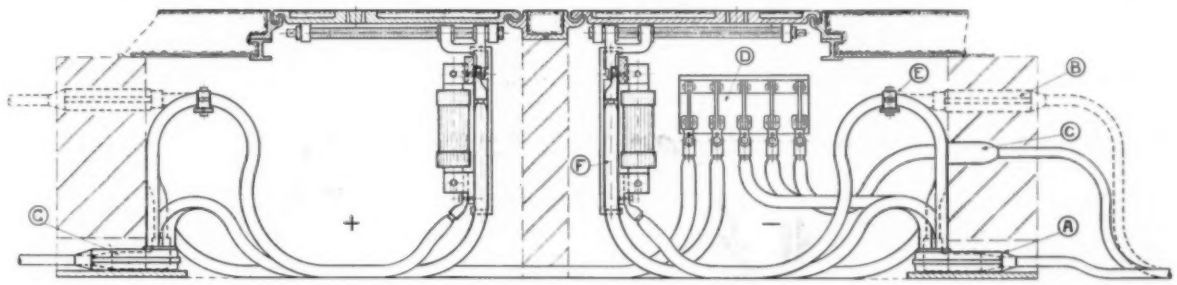
I have pleasure in complying with Mr. Abraham's request for a sketch giving an idea as to the sealing and attachment of the cables in my new distribution-box design. I take it that it will be agreed that the best way for installing the cable work can only be decided after examination of the ground and contents at the place selected for the distribution point. This, in fact, obtains for every large distribution box of whatever design. In hardly two cases on a network are the cables similarly arranged in their approaches to the box. Each case presents its own difficulties to be overcome on account of existing gas, water, and other pipes. The drawing shows what has been in my mind as a picture of the cable work, and I think that something like the arrangement should be adopted for each design—the one shown and also for the central screw design—but the size of the containing pit could be altered according to the cable sizes. The drawing is of a design for 1.0-sq. in. feeder and 0.5-sq. in. distributor cables.

All the sealing end or trifurcating boxes could lie at the bottom level of the pit, and the tail flexible cables be brought out of the top of the box through insulators as at A. As, however, it will be advisable, as mentioned in my letter of June 28th, to cleat the flexibles to a fixed position half way along the vertical lift E, the tail end boxes could equally well be placed directly on the horizontal line of E, as shown dotted at B, which arrangement would shorten the length of flexible required.

It should, perhaps, be made clear that the negative cable coming from a trifurcating box at G would pass right along the pit and be cleated at E on its way to its particular fuse terminal. Positive cables from A position would be similarly treated and cleated in the corresponding cleat in the positive end of the pit, thus making all cables the same length for each pole between the fixed cleat and the distributor fuse terminal, and thus ensuring that all cables attached to one panel describe the same movements. The neutral feeder cable may finish in a pot head as at C, and be taken straight on to the neutral panel D. The other poles of the feeder cable would be cleated up the edges of their respective panels as shown at F.

It is very difficult to show on a drawing all the cables required, as several take the same line, and I submit that to an electrical man the arrangement of the cables in the case of boxes of these designs is only an every-day problem of fairly easy solution. The first box installed should have some time and care spent on it to make it a pattern for future work.

I shall be pleased to deal with any further specific queries if necessary.



Cable Arrangements for Lee Network Box.

L. R. Lee,
Mains Engineer.

Electricity Department, Manchester.
July 28th, 1926.

Hydro-Electric Development in France.—The French Minister of Public Works has been authorised by the French Cabinet to draw up a scheme for the establishment of a special fund for the development of the water resources of France by means of a special tax on users of electricity. The proposal is based on the principle that the industrial importance of a country depends largely on its power resources. France, so far as steam power is concerned, is largely dependent on coal, large quantities of which have annually to be imported, while its large resources of water power are only partially utilised, owing to the financial difficulties through which the country is passing. Steam-operated power stations, which mean a further increase in coal imports, are relatively easy to establish. On the other hand, it is difficult to raise money for the construction of hydro-electric plants. It is therefore proposed to endeavour to create greater interest in hydro-electric development by imposing a tax on electricity consumption of 5 per cent. It is estimated that this would produce a sum of about 150 million fr. a year, which would enable the Government to make more liberal grants towards the construction of hydro-electric power stations, many of which are projected, but which, owing to the financial stringency, are in a state of suspense.

Legal.

Workman's Compensation Claim.

IN the Bow County Court, on July 26th, before Judge Hargreaves, Charles Marks, Abbey Wood, a greaser, was the applicant in a Workmen's Compensation Act claim, the respondents being the India Rubber, Gutta Percha and Telegraph Works Co., Ltd. The applicant said that whilst working amongst the machinery at the company's Silvertown factory, oiling it, his right hand was caught, and he lost the tops of two fingers. It was difficult and dangerous work, as he had to climb ladders and work amidst whirling machinery. It was quite a common thing for him to catch his clothes in the machinery while it was revolving—two or three times a week—besides which he had met with two previous accidents at the factory, sustaining injuries to his fingers. His disabilities did not end there, as during the war an exploding shell smashed the tops of several fingers of his left hand, ruptured his right eye, and caused cataract in the left. The respondents had ceased to give him compensation, which he had been receiving at the rate of 23s. 4d. a week, on the ground that he was capable of doing something or other. It was quite certain he could never work in the machinery again. For the respondents, the engineer in charge gave evidence, and said he thought the applicant could carry out his work if he did not have to climb, and he might be able to find him a job if he was willing to do it.

Judge HARGREAVES decided that there was still disability, and he awarded the man 11s. 8½d. per week from the date of cessation and to continue.

British Thomson-Houston Litigation.

MR. JUSTICE TOMLIN, in the Chancery Division on July 29th, had before him a motion by the British Thomson-Houston Co., Ltd., against Henri Engel and the Naamlooze Vennootschap Nederlandsche Gloeilampen Industrie Neglin, of Nymegen, Holland, for injunctions restraining infringements of its letters patent for incandescent electric lamps.

Counsel said that the parties had come to terms, and the defendants had agreed to treat the motion as the trial of the action, and to submit to a perpetual injunction. Damages and delivery up of infringing articles had been settled by correspondence.

Mr. BOUSFIELD, for Mr. Engel, said it had been agreed that he should return to the defendants in Holland his stock of lamps.

Compensation Granted to the Cork Electric Tramways and Lighting Co., Ltd.

IN the Cork Circuit Court, before Judge Kenny, last week, the Cork Electric Tramways & Lighting Co. applied for £450, compensation for damage done to its power station at Queenstown. A decree for £405 was granted to the company.

Long-Firm Frauds.

CHARLES COHEN and Louis Weiner, who, as previously reported, were charged with long-firm frauds at Leicester in connection with electrical and radio apparatus, were sentenced at Leicester Quarter Sessions, on July 28th, Cohen to 22 months' hard labour and Weiner to 12 months without hard labour. The Recorder said he regarded Cohen as the principal and Weiner as his dupe. There were 12 counts in the indictment, all relating to electrical and allied firms, goods to the value of many hundreds of pounds having been obtained, none of which was paid for. Cohen had established an elaborate system of false trade references. Since he knew that the police were inquiring for him Cohen went to America, where he pursued similar practices at Detroit (stated Det.-Supt. Boon). Weiner was sentenced to 21 months' imprisonment at Leicester last year for similar frauds.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from July 28th. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Magnastat. No. 470,641. Class 6. High starting torque a.c. motors.—Harland Engineering Co., Ltd.

Amplrito. No. 461,663. Class 8. Automatic filament current adjusters.—Samuel Ruttenberg & Meyer, Liebowitz, New York. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Cathermo. No. 470,625. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—British Instrument Co., Ltd., Hendon Aerodrome, N.W.8.

Levydyne. No. 470,735. Class 8. Apparatus for use in telegraphy and telephony.—Lucienne Levy, Paris. (Mewburn, Ellis & Co., 70-62, Chancery Lane, W.C.2.)

Ethopower. No. 470,895. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Burndept Wireless, Ltd.

Gary (lettering and design). No. 459,387. Class 13. Electric switches and fusible cut-outs.—La Société Appareillage Gardy, Geneva. (Andrews & Beaumont, 201-206, Bank Chambers, 29, Southampton Buildings, W.C.2.)

Briticent. No. 468,830. Class 13. Fuses, switches, plug sockets and hand lamps, all being electrical goods.—The British Central Electric Co., Ltd.

Mundial. No. 469,712. All electrical apparatus and fittings in Class 13.—La Société l'Appareillage Electrique de la Seine, Courbevoie, Seine, France. (Chatwin & Co., 253, Gray's Inn Road, W.C.1.)

Neron-Bilux. No. 469,922. All goods in Class 13.—Osram Gesellschaft, Berlin. (Cruikshank & Fairweather, 65-66, Chancery Lane, W.C.2.)

Cocusite. No. 469,851. Class 50. Electrical insulating coverings and electrical fittings.—A. P. Lundberg & Sons.

Published Specifications.

Compiled expressly for this journal by Patent Agents
The name of the applicant's patent agent, if any, will be found on the printed specification.
The number in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1925.

6,552. "Electrical protective arrangements for alternating-current systems." A. J. King, W. J. Brown, and Metropolitan-Vickers Electrical Co., Ltd. March 10th, 1925. (254,770.)

6,553. "Electrical protective arrangements for alternating-current systems." W. J. Brown and Metropolitan-Vickers Electrical Co., Ltd. March 10th, 1925. (254,771.)

8,665. "Switches." F. B. Cox. April 1st, 1925. (254,776.)

8,730. "Electric telegraph systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd..) Western Electric Co., Inc. April 1st, 1925. (254,779.)

9,155. "Electrical railway traffic control devices." W. H. Reichard. April 6th, 1925. (254,789.)

9,165. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). April 6th, 1925. (Cognate application, 15,611/25.) (254,790.)

9,270. "Electric switches." J. P. Keith, J. Cruwys, and Power Equipment Co., Ltd. April 7th, 1925. (254,793.)

9,533. "Electrical switches." A. L. Vandervekke and V. Mallentjer. April 9th, 1925. (254,801.)

9,563. "Mountings for coils used particularly in radio-telephony." F. R. Stanley. April 9th, 1925. (254,809.)

10,260. "Electrical control apparatus." R. Maclaren. April 20th, 1925. (254,821.)

10,546. "Insulation of wires used in the making of induction coils or other apparatus used in wireless engineering." J. L. Sands. April 23rd, 1925. (254,824.)

11,374. "Apparatus for charging accumulators." H. C. H. Smyth. May 1st, 1925. (254,828.)

11,437. "Telephone systems." Siemens & Halske Akt.-Ges., and Dr. M. Mathias. May 2nd, 1925. (254,830.)

11,762. "Means of removing plug-in coils and like components as used in wireless apparatus from their holders." G. Forster. May 6th, 1925. (254,836.)

12,001. "Measurement of cross-talk on telephone circuits." Callender's Cable & Construction Co., Ltd., and J. Urmston. May 8th, 1925. (254,838.)

12,080. "Supply of current to wireless apparatus." E. B. Doughty. May 9th, 1925. (254,840.)

12,372. "Synchronous telegraphy." Muirhead & Co., Ltd., E. S. Heurtley, and J. V. Foll. May 12th, 1925. (254,842.)

12,511. "Wireless variable coil holders." J. H. Peters. May 14th, 1925. (254,844.)

12,534. "Electric switches." Sykes & Dyson, Ltd., and P. Sykes. May 14th, 1925. (254,845.)

13,193. "Electrically-operated timing-mechanism for electric signalling apparatus." C. A. Jensen (J. A. Stone, J. H. Boyden, and W. C. Prentiss). May 20th, 1925. (254,849.)

13,303. "Automatic means for earthing the aerial of wireless installations." P. Elphick. May 21st, 1925. (254,851.)

13,566. "Charge indicators for secondary galvanic batteries." J. Lumsden. May 25th, 1925. (254,852.)

16,195. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and R. R. Winship. June 23rd, 1925. (254,865.)

17,694. "Electric ovens and heating-appliances therefor." S. D. White and T. Settle. July 10th, 1925. (254,879.)

18,188. "Decorated incandescent electric lamps." Z. Hadnagy and V. G. De Christian. July 16th, 1925. (254,883.)

18,317. "Automatic arc-welding systems and apparatus therefor." British Thomson-Houston Co., Ltd. July 21st, 1924. (237,275.)

20,291. "Method of and means for manufacturing electrical resistance bodies." H. Pender. August 12th, 1925. (254,894.)

20,640. "Dry battery cells." Revivo Battery Corporation. September 17th, 1924. (240,140.)

21,094. "Apparatus for regulating electric circuits." F. Raimondi. August 22nd, 1925. (254,899.)

21,418. "Apparatus for amplifying electric currents." Westinghouse Brake and Saxby Signal Co., Ltd. April 18th, 1925. (250,895.)

22,653. "Electric distance control systems." E. Granat and Compagnie des Forges and Acieries de la Marine et d'Homecourt. September 20th, 1924. (240,151.)

23,162. "Abutment devices for application to flexible electric conductors for the purpose of resisting a tensile effort between such conductors and elements such as lampholders, plug-and-socket connections, ceiling roses and the like with which they are associated." J. A. Crabtree. September 17th, 1925. (254,911.)

23,657. "Oil-cooled electric transformers." British Electric Transformer Co., Ltd., and J. Roothaan. September 22nd, 1925. (254,914.)

24,387. "Alternating-current relay." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines à Gaz. September 30th, 1924. (240,843.)

25,334. "Exhaustion of closed containers such as are used for thermionic discharge devices." Westinghouse Electric & Manufacturing Co. October 14th, 1924. (241,548.)

26,672. "Starters of electrical appliances." Dubilier Condenser Co. (1925), Ltd. October 24th, 1924. (241,947.)

26,844. "Covers or closure members for use in connection with electric switches and other electric accessories and the manufacture thereof." J. A. Crabtree. October 27th, 1925. (254,934.)

27,488. "Systems of electric distribution." British Thomson-Houston Co., Ltd. November 1st, 1924. (242,309.)

29,447. "Space discharge tube amplifying systems." Standard Telephones and Cables, Ltd. December 13th, 1924. (244,442.)

29,653. "Method and means for metallising insulating bands, particularly for use in electric condensers." Dubilier Condenser Co. (1925), Ltd. November 24th, 1924. (243,393.)

30,701. "Stranded electric conductors for high-tension cables." Felten and Guilleaume Carlswerk Akt.-Ges. December 4th, 1924. (244,119.)

30,707. "Electric motor controllers." A. A. Thornton (Cutler-Hammer Manufacturing Co.). December 4th, 1925. (254,968.)

30,970. "Electric furnaces." British Thomson-Houston Co., Ltd. December 27th, 1924. (245,089.)

31,222. "Submarine cables." Felten & Guilleaume Carlswerk Akt.-Ges. December 10th, 1924. (244,478.)

31,548. "Supports for electric lamps." L. D. des Gachons. December 14th, 1925. (254,972.)

32,348. "Automatic electric motor-starting controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). December 22nd, 1925. (254,980.)

32,368. "Telephony with four-wire circuits." Felten & Guilleaume Carlswerk Akt.-Ges. January 26th, 1925. (246,450.)

32,752. "Electric condensers." B. R. Webster. December 29th, 1925. (254,983.)

1926.

1,380. "Sound-reproducing devices." British Thomson-Houston Co., Ltd. February 4th, 1925. (247,164.)

3,364. "Self-starting synchronous motors." British Thomson-Houston Co., Ltd. February 5th, 1925. (247,209.)

5,198. "Devices for locking electric lamps, fuses, and the like." A. E. White (Kulo Theftproof Lamp Co.). February 23rd, 1926. (254,977.)

5,384. "Electro-mechanically-controlled automatic signalling device for vehicles and the like." Auto-Signal Soc. Anon. February 28th, 1925. (248,379.)

7,511. "Light-projecting devices." British Thomson-Houston Co., Ltd. March 18th, 1925. (249,539.)